Heating Piping & Air Conditioning

SEPTEMBER 1957

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INDUSTRIAL • COMMERCIAL • INSTITUTIONAL • PUBLIC BUILDINGS

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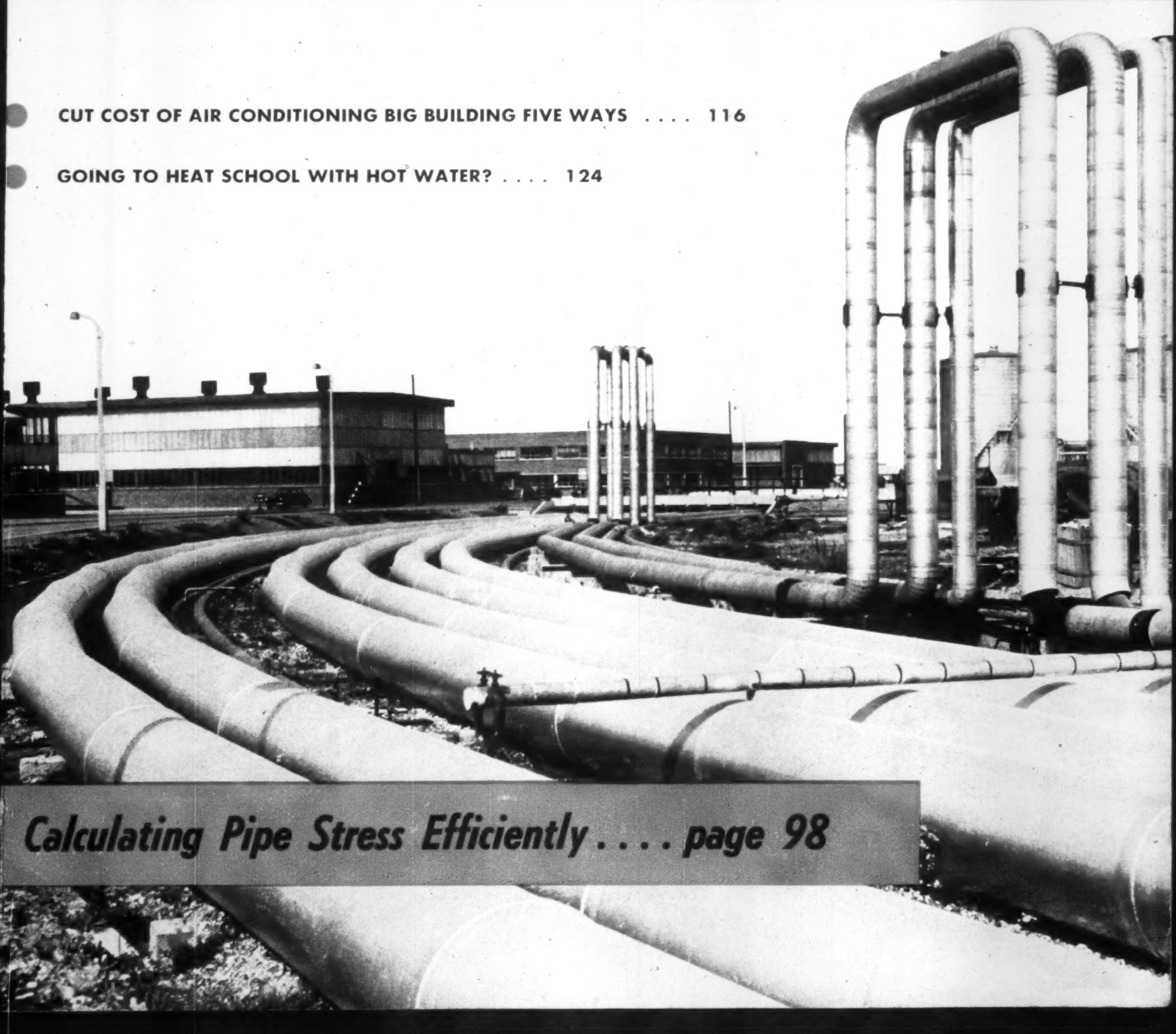

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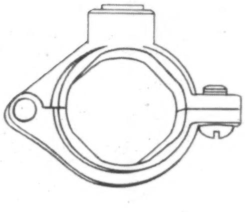

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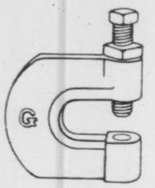

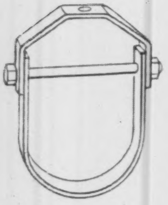

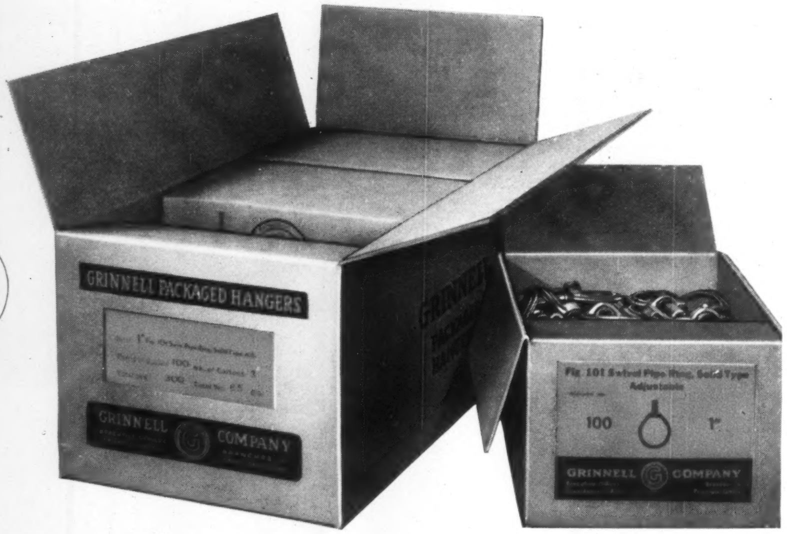
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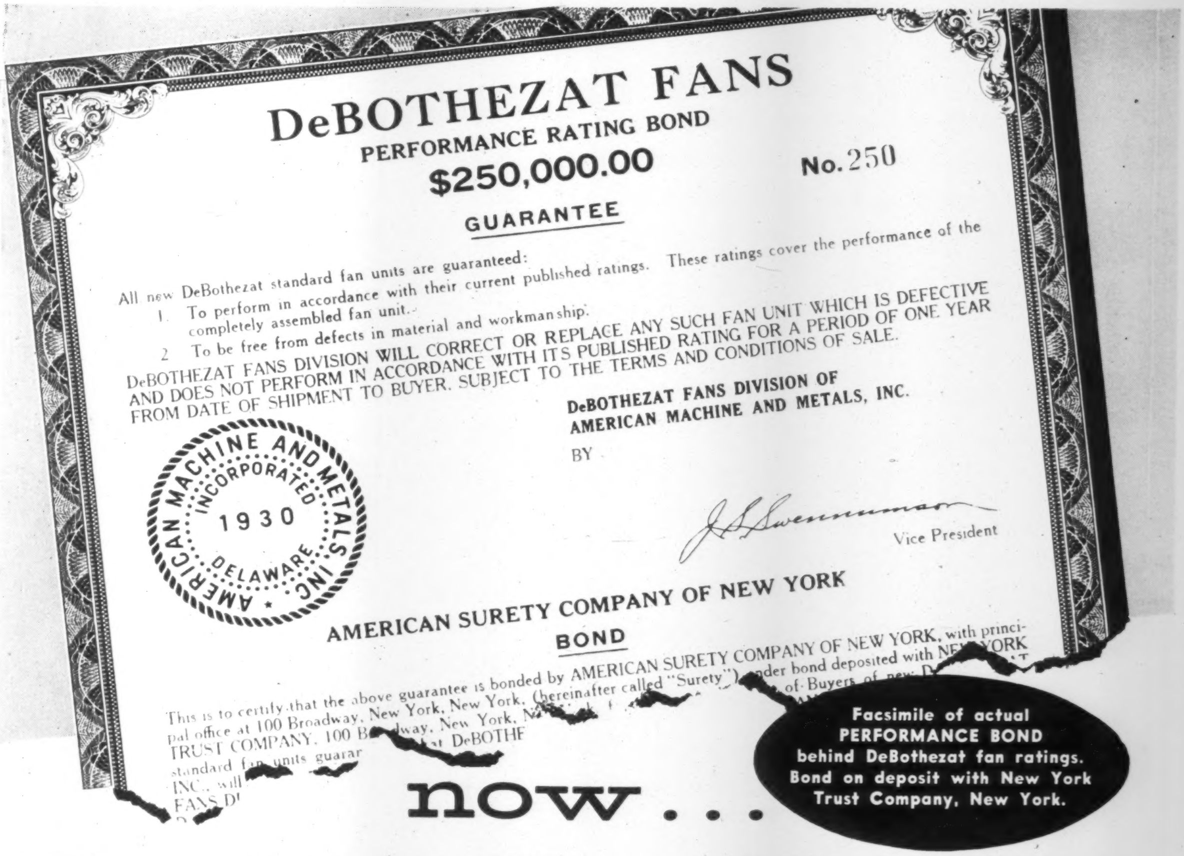

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BY

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Vice President

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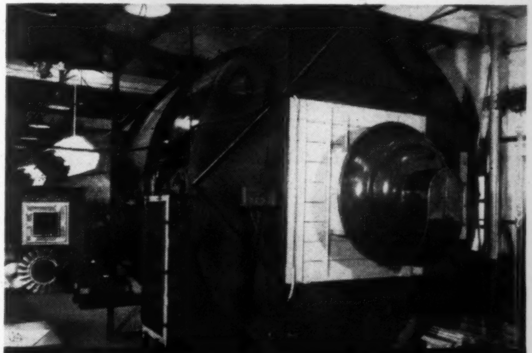

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Vol. 29 No. 9

September 1957

(With which is merged the Aerologist)

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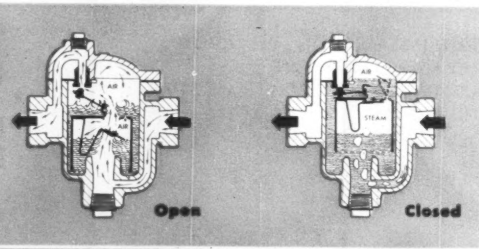
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AIR
Open
AIR
STEAM
Closed

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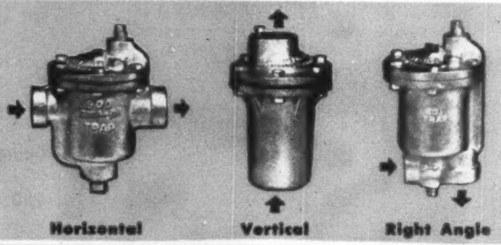
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Vertical
Right Angle

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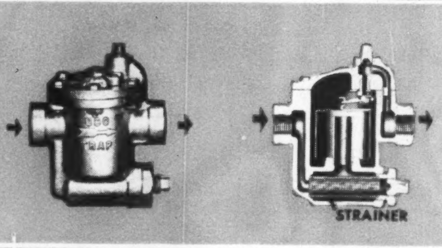

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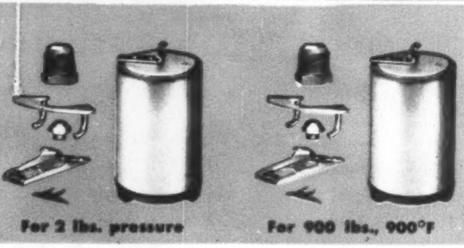
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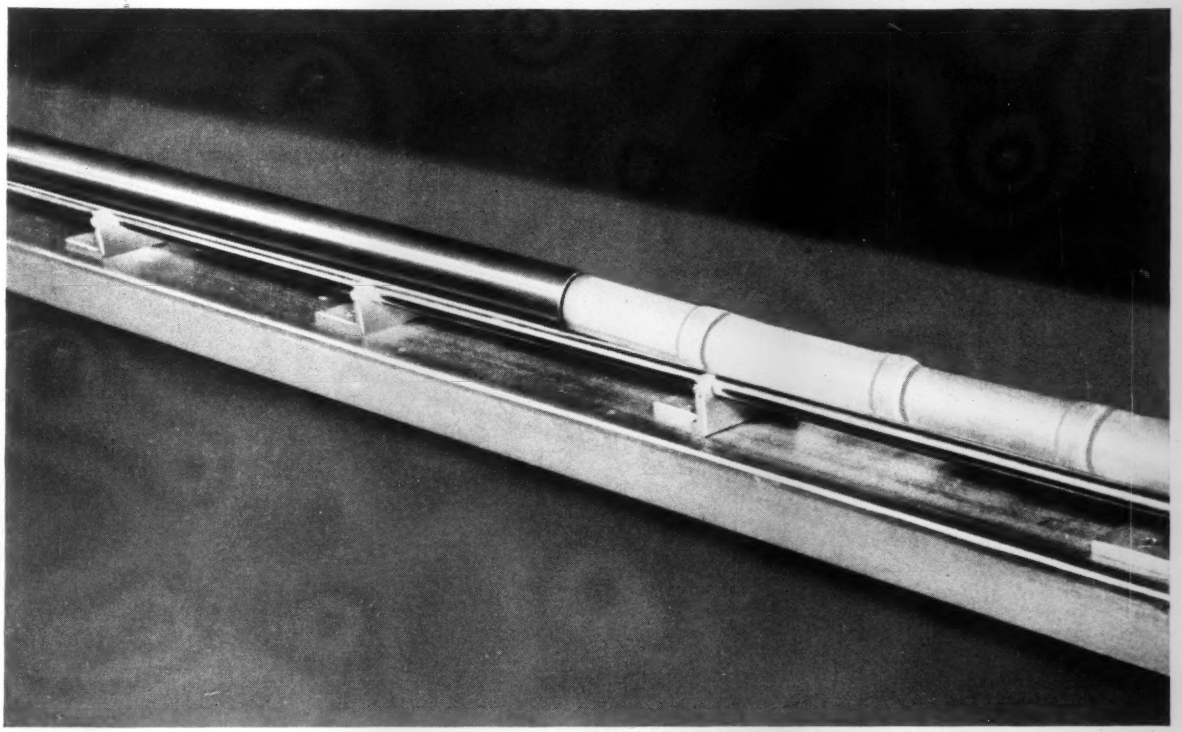

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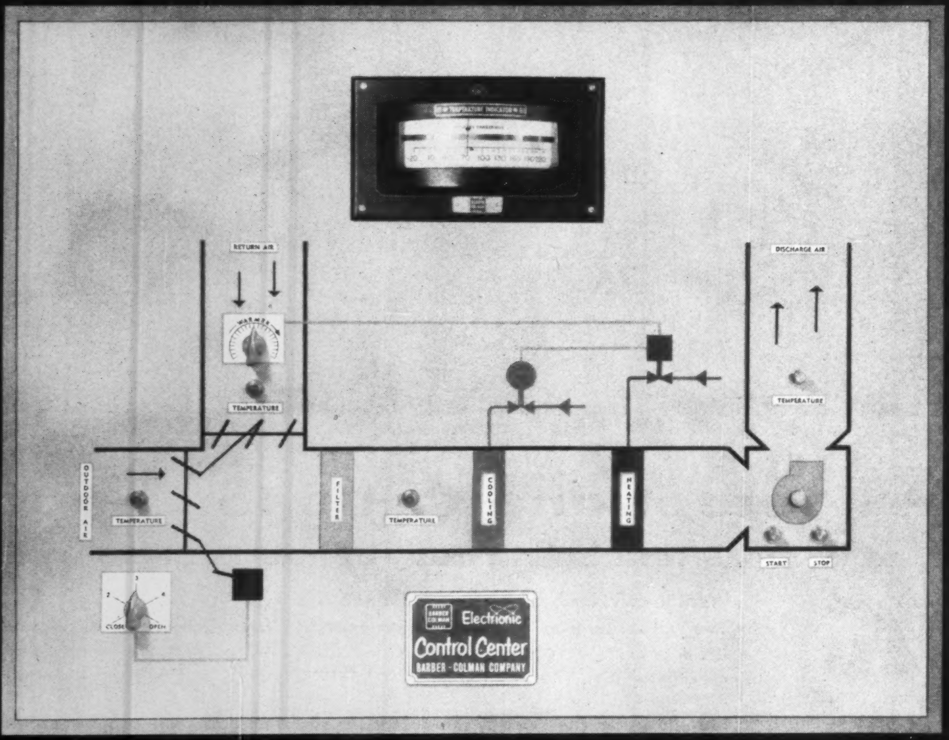
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RETURN AIR
WARMER
TEMPERATURE
DISCHARGE AIR
TEMPERATURE
OUTDOOR AIR
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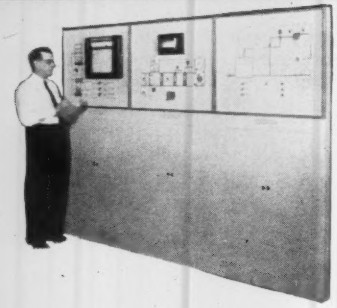

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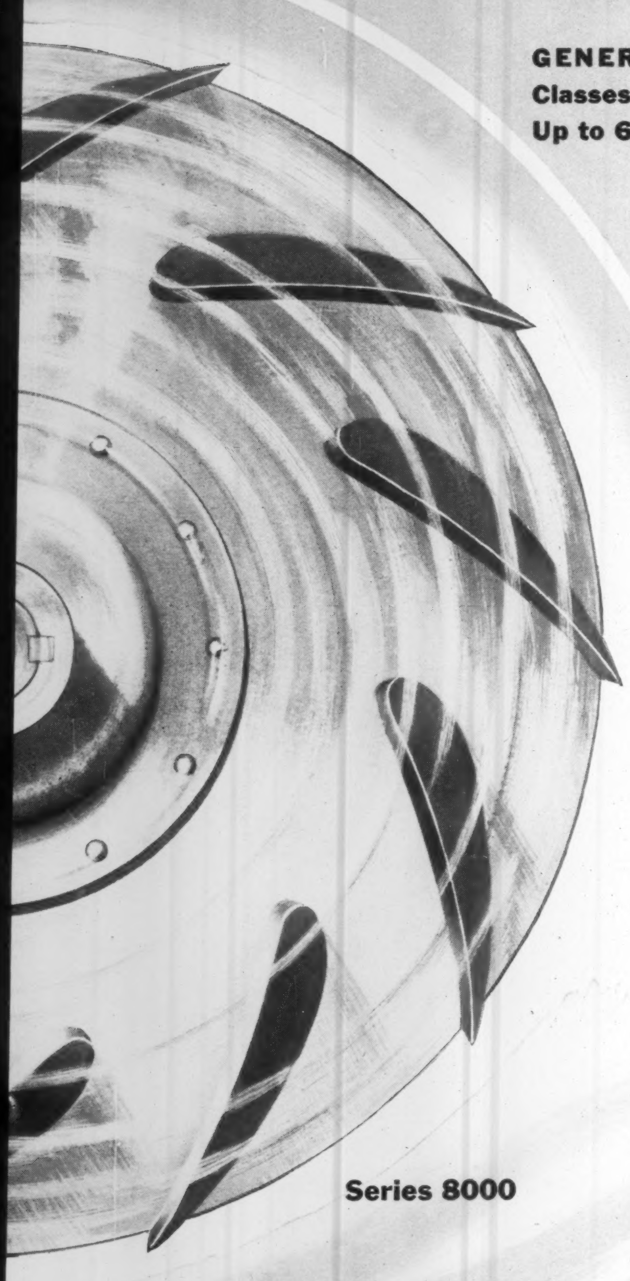
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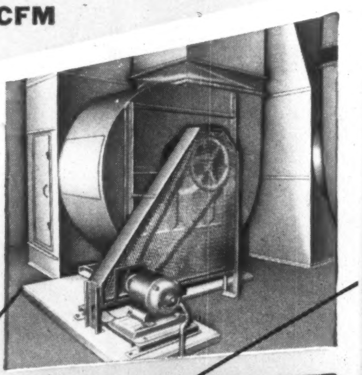

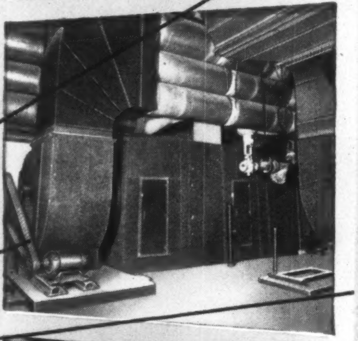

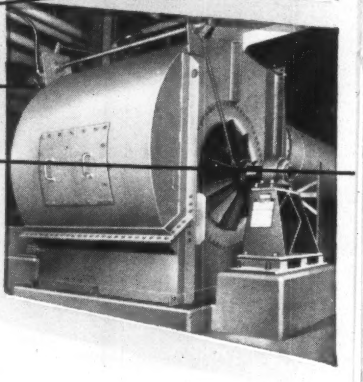

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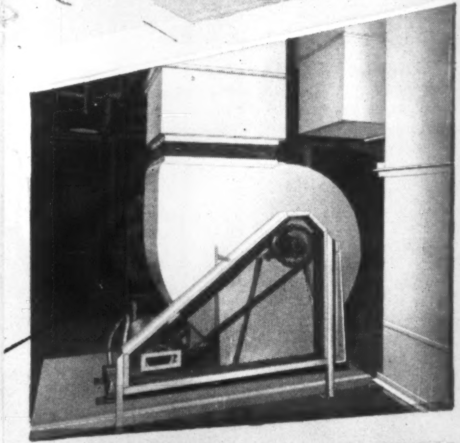

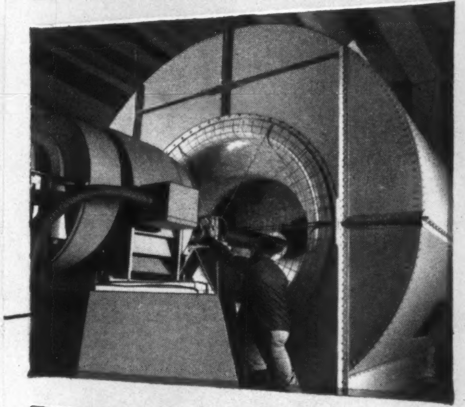

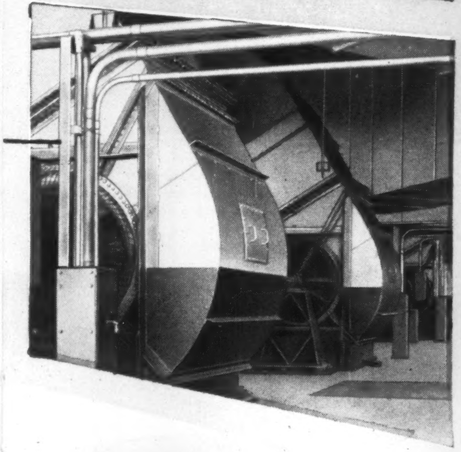

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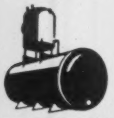
DEAERATING HEATERS

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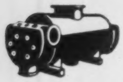
EJECTORS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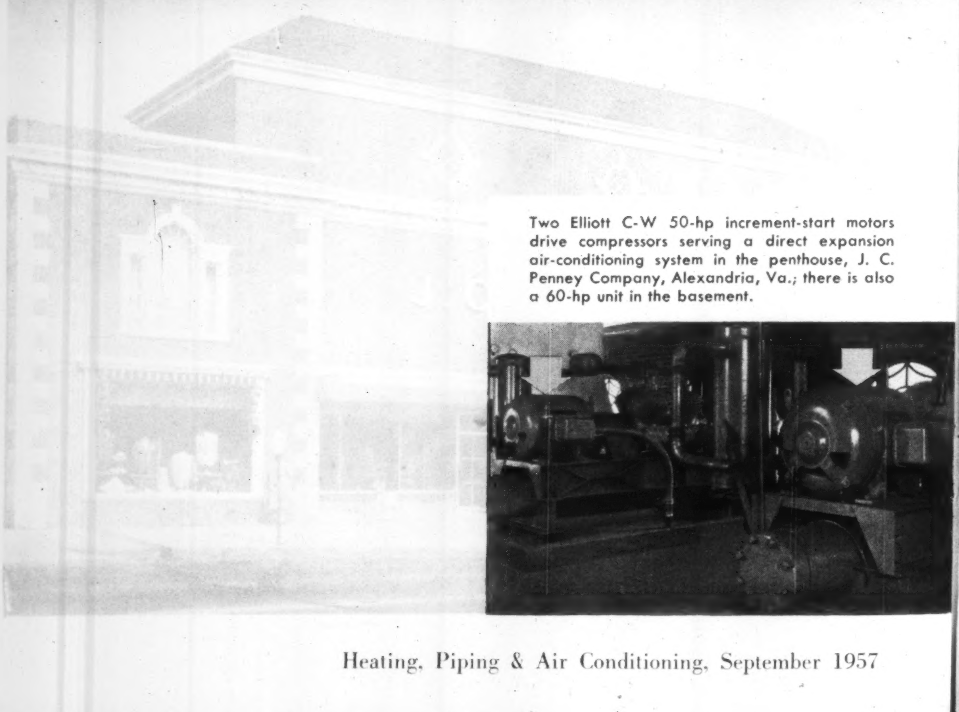
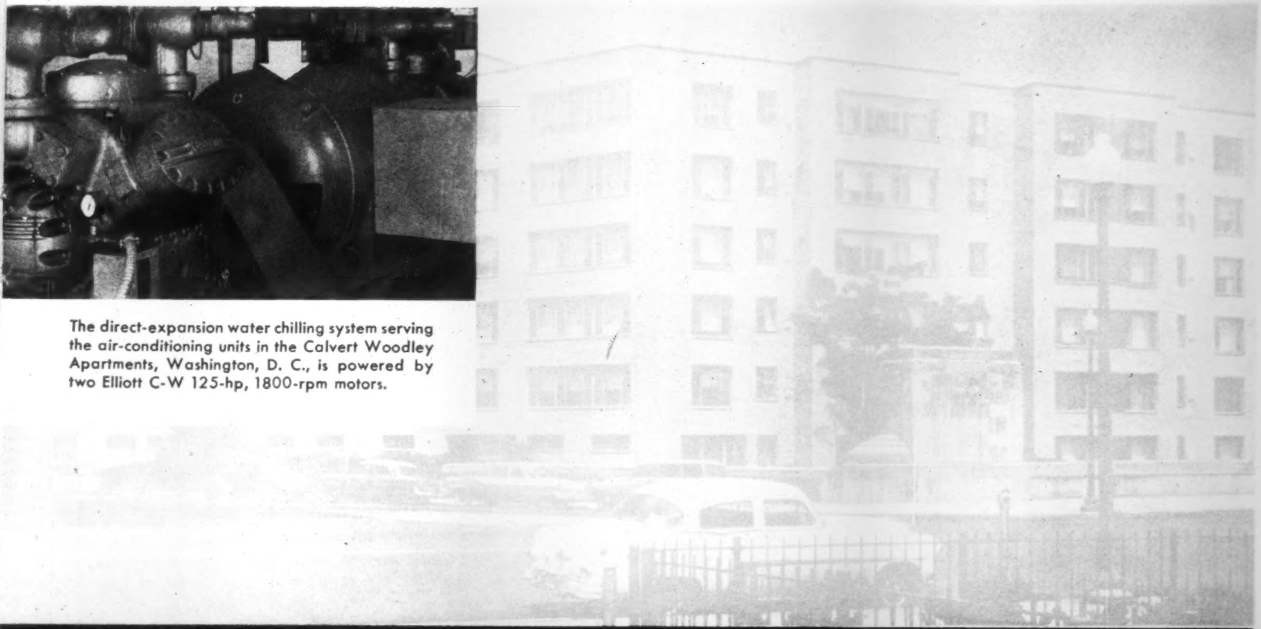

Two Elliott C-W 50-hp increment-start motors drive compressors serving a direct expansion air-conditioning system in the penthouse, J. C. Penney Company, Alexandria, Va.; there is also a 60-hp unit in the basement.

W7-2



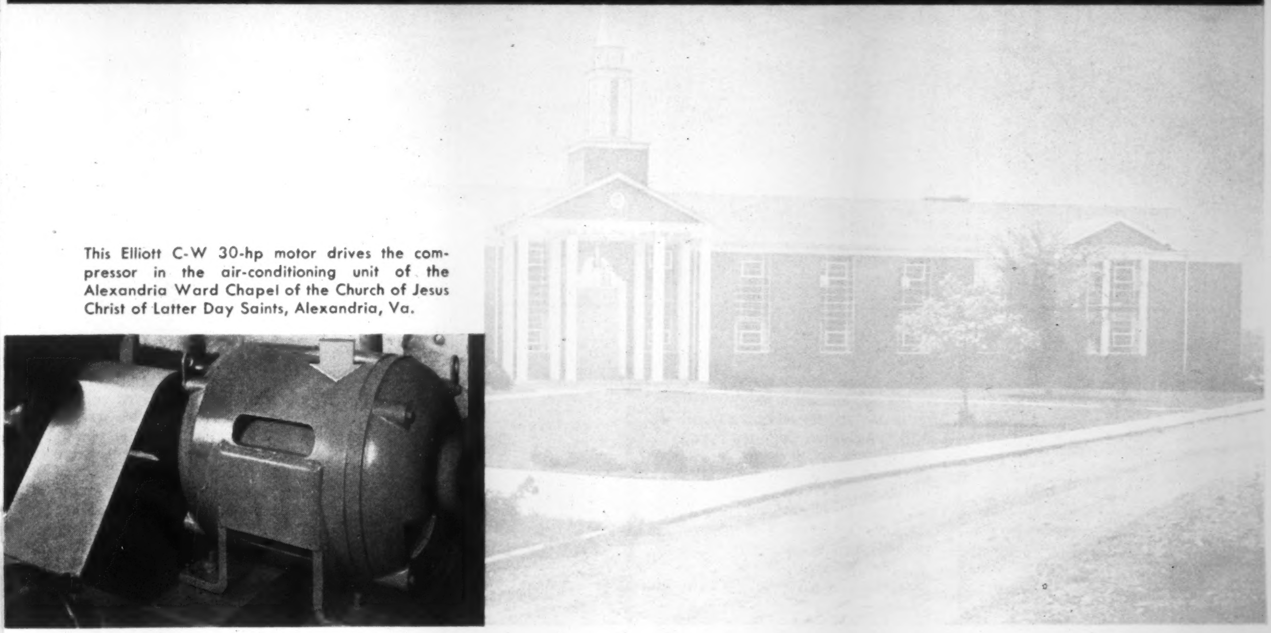
The direct-expansion water chilling system serving the air-conditioning units in the Calvert Woodley Apartments, Washington, D. C., is powered by two Elliott C-W 125-hp, 1800-rpm motors.

These Elliott C-W motors serving Carrier air-conditioning units in or near Washington, D.C., are only a few examples of what is happening in cities all over the country. Because of their superior performance and long-term dependability, the popular Elliott C-W motors are repeatedly selected to drive compressors, pumps, and other auxiliary equipment.

* * *

For details, contact your nearby Elliott district office, or write Elliott Company, Crocker-Wheeler Division, Jeannette, Pa.

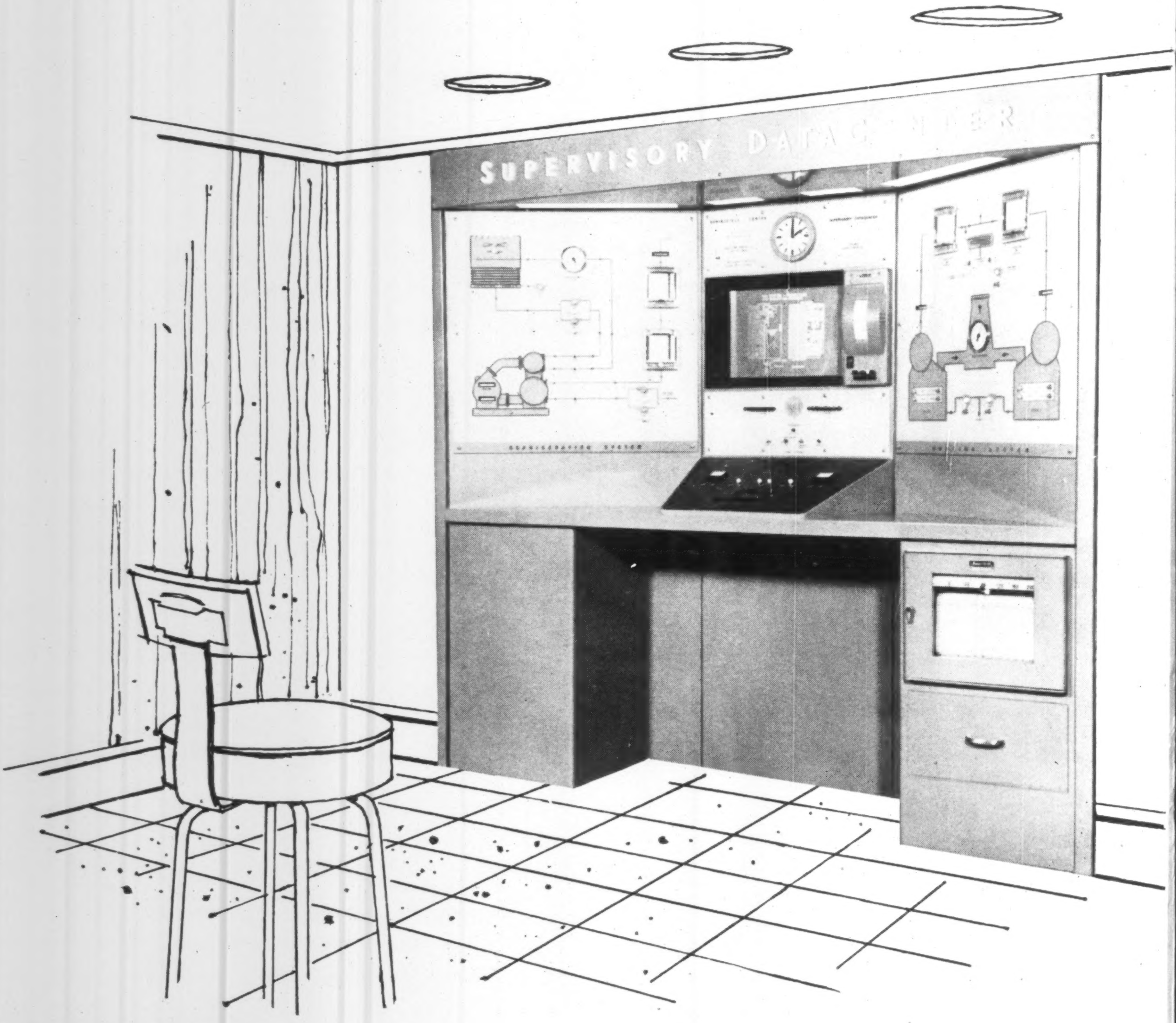
ELLIOTT Company



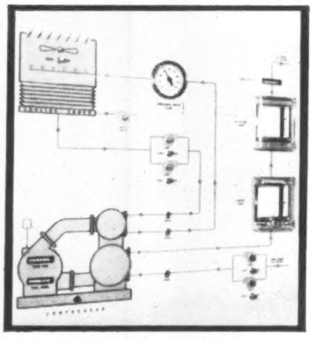
This Elliott C-W 30-hp motor drives the compressor in the air-conditioning unit of the Alexandria Ward Chapel of the Church of Jesus Christ of Latter Day Saints, Alexandria, Va.

Next logical step in control panel development

HONEYWELL SELECTOGRAPHIC

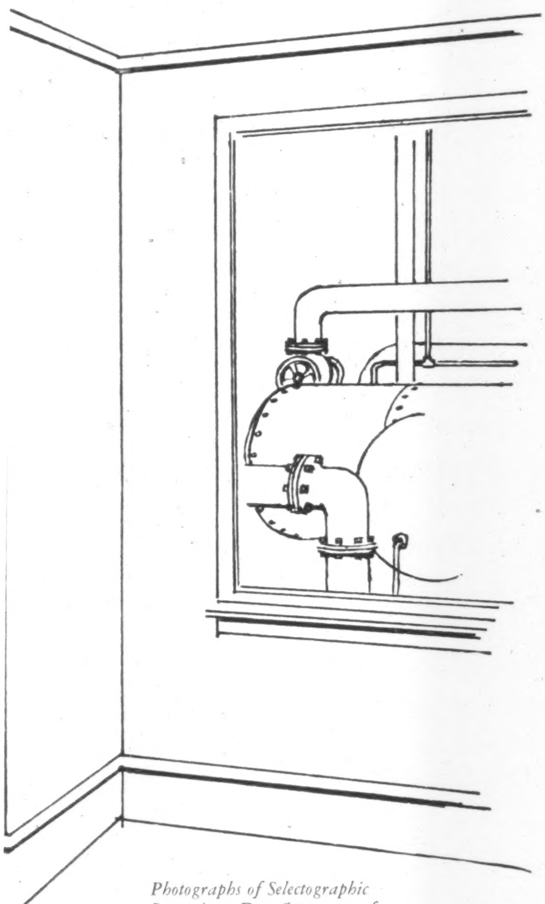


Center panel. Main feature here is the projection screen which replaces system diagrams and floor plans that take up much of the area on present panels. Here, on one screen, the desired diagram or plan is flashed, while at the same time console controls are switched to the system shown. Other features include temperature indicator, intercom control and push-buttons for temperature logging and system adjustments.



Refrigeration panel. All major electrical accessories of refrigeration system can be started and stopped from this panel. The chilled water temperature is controlled by a Tel-O-Set* instrument in the chilled water supply line. A second Tel-O-Set indicates and records cooling output in Btu. The total Btu output is shown on a numerical counter which can be compared to the total electrical imput shown on a similar counter.

SUPERVISORY DATACENTER*



Photographs of Selectographic Supervisory DataCenter are of pilot model being demonstrated in all principal cities.

Panel of tomorrow has revolutionary systems and floor plan projector that automatically gives visual picture of operation of entire air conditioning system.

IN A BUILDING equipped with a Honeywell Selectographic*, the engineer will be able to take a "look" at any part of his air conditioning system merely by pushing a button.

On his screen he will be able to project, one at a time, as many as 50 fan system diagrams and floor plans.

What this means is that at one small console he can control, with precision, the air conditioning system in even the largest building. For as any given floor plan appears, controls and dials are automatically switched to correspond with the plan. This provides, within a small space, all the advantages of larger panels that have permanent system diagrams and floor plans.

Each projected plan will contain symbols to show what readings or adjustments may be made at the panel.

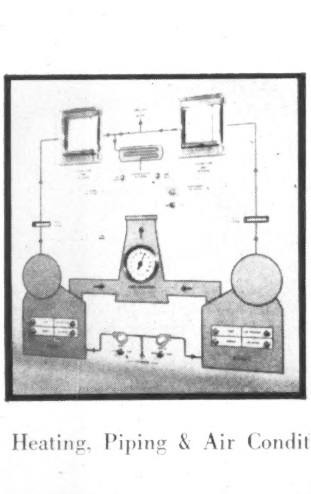
An intercom has been built into this Supervisory DataCenter to enable the engineer to talk to his men working on any part of the system.

And from this one location in his office the engineer can read and adjust key temperatures throughout the building—outside air, mixed air, discharge from cooling and heating coils, return air, space thermostats, hot and cold ducts in dual-duct systems.

Besides all the new advantages, this Selectographic DataCenter offers the traditional benefits of Honeywell electronic control panels: Greater operating efficiency with less personnel time, more efficient use of specialized manpower . . . longer equipment life . . . operational savings that liquidate cost . . . attractive display of your engineering design . . . and a more comfortable building.

For further information about the Selectographic DataCenter (custom designed to fit the needs of the individual building), call your local Honeywell office. Or write to Minneapolis-Honeywell, Dept. HA-9-245, Minneapolis 8, Minnesota.

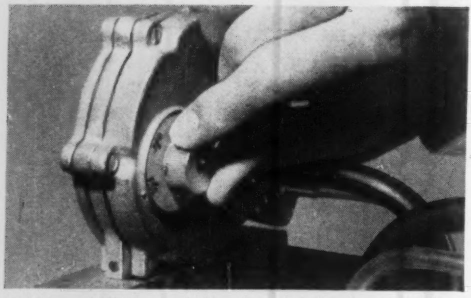
*trademark



Heating panel. Lights indicate the status of the pilot and main burner. Warning lights respond to steam pressure and water level. Stack temperature is continually indicated. Tel-O-Set* instruments also indicate and record steam pressure and flow from each boiler. Total steam flow is indicated on a numerical counter for each boiler. Complete operation of the boiler plant can be supervised from this section of control panel.

For news about
another major
Honeywell contribution
to indoor climate,
turn the page. ⟶

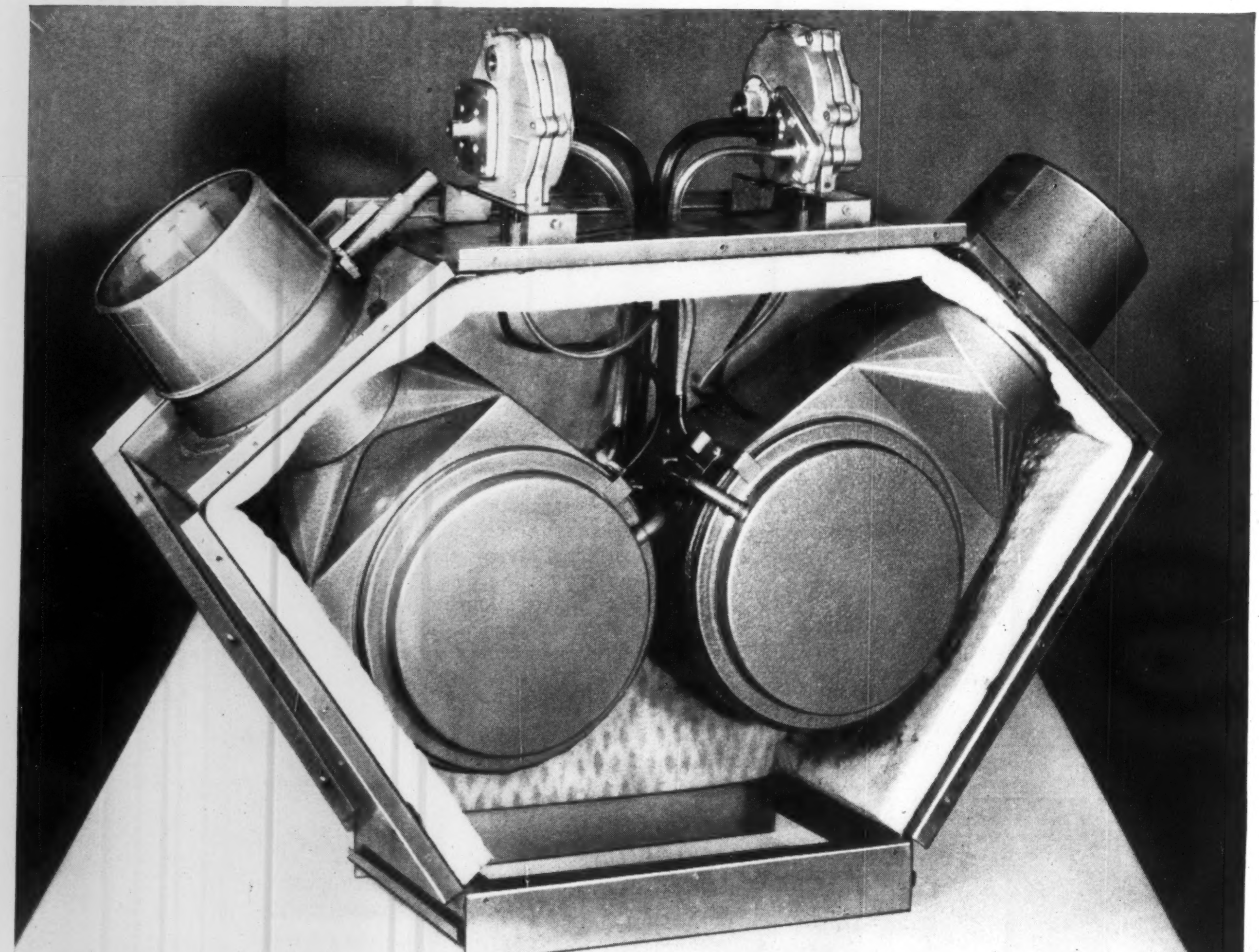
Control Leadership through
advanced engineering-research



Calibrated dial air balancing is the key to the superior performance of the Honeywell High Velocity Air Blender. You adjust dial only once, need never recalibrate again. Once balanced, comfort control is in the hands of the system thermostats.

Dial Air Balancing

NEW HONEYWELL HIGH VELOCITY



Fits any mixing box. The configuration you see here is but one of the many possible for ceiling units. Also, it's now available in nearly every under-the-window type unit. From the new Honeywell Blender you can expect controlled volume of air, constant CFM, long valve life and simplified control. The thermostat in the system controls temperature by controlling the volume of hot air passed by the hot duct. At the same time a flow regulator provides a constant hot air volume for a given thermostat signal under variations in supply duct pressures. A constant total flow is provided by a total flow regulator which operates the cold air valve to make up the difference between hot flow and desired total flow.

Control leadership through advanced engineering—research

AIR BLENDER SOLVES DUAL-DUCT DISTRIBUTION PROBLEMS

Provides constant delivered air volume, needs no recalibration when you add to system

With the new Honeywell Air Blender your clients get the level of comfort they want—on the simple call of the room thermostat.

They get this easily, because the Honeywell Air Blender combines temperature and volume control in one unit.

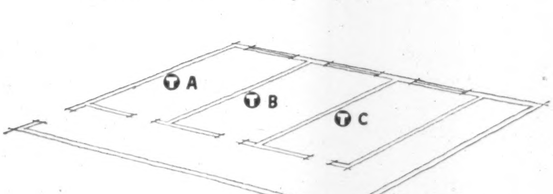
And comfort doesn't come at the expense of some other room. It comes from the system. *One room no longer "robs" another of comfort.*

Besides providing constant delivered air volume, the Honeywell Air Blender takes well to change. With Dial Air Balancing you can add to the system without having to recalibrate distribution points that may be scattered widely—especially valuable in floor by floor modernization or on new construction.

Self-powered, the Honeywell Air Blender uses the pressure of the air it is controlling to actuate the diaphragm—its only moving part. Such simplicity makes possible long life and trouble-free performance.

For further information about the Honeywell High Velocity Air Blender and other Honeywell heating and air conditioning products, call your local Honeywell office. Or write to Minneapolis-Honeywell, Dept. HA 9-245, Minneapolis 8, Minnesota.

No room "robs" comfort from another



For the first time in high velocity air handling history you can design a system where adjustment in one room doesn't upset comfort balance in others. Thus, in a typical office, adjustment in area A does not rob comfort from B or C. Neither delivered air volume, nor the ratio of hot to cold air is affected in B or C. This is one of the reasons why it's wise to design with the new Honeywell Air Blender in mind.

H
Honeywell

The "new" look in thermostats that's appearing on walls of commercial buildings throughout America. New design *inside* gives closer control, vastly superior performance.

Only Honeywell gives you all four—pneumatic, electric, electronic, instruments.

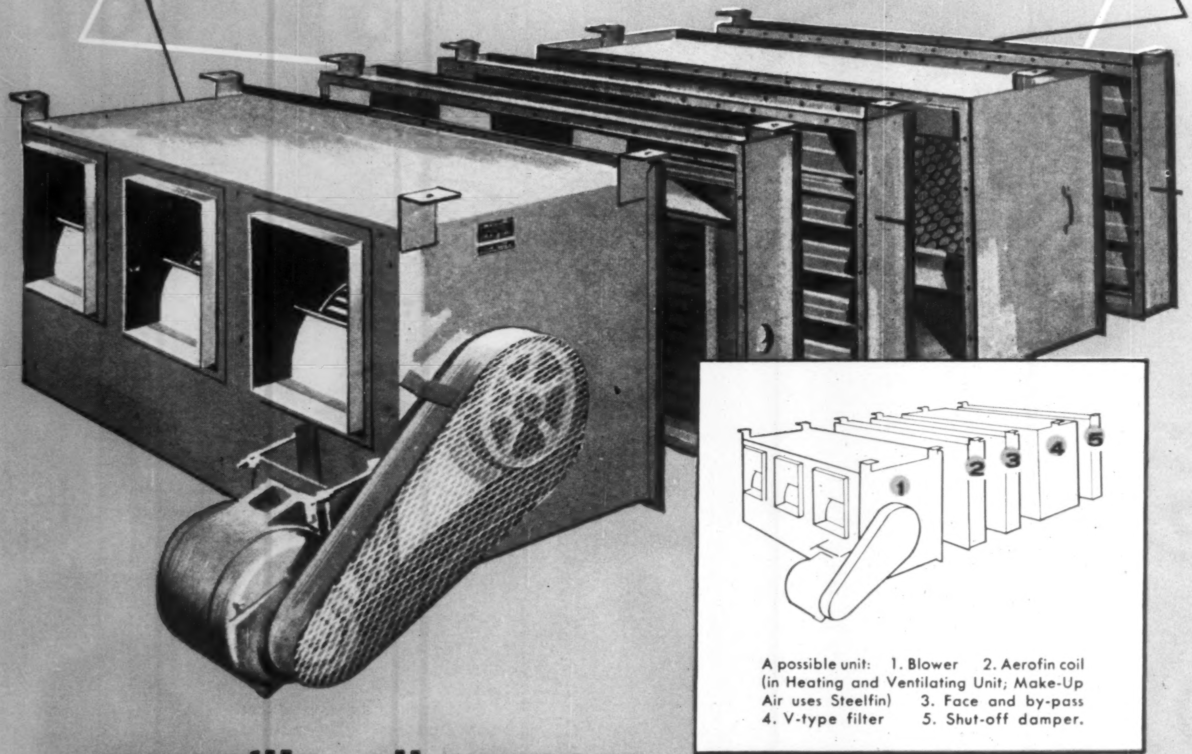
Honeywell

H HONEYWELL First in Controls

. . . the Make-Up AIR family

proudly presents a new addition . . .

HEATING AND VENTILATING UNIT



A possible unit: 1. Blower 2. Aerofin coil (in Heating and Ventilating Unit; Make-Up Air uses Steelfin) 3. Face and by-pass 4. V-type filter 5. Shut-off damper.

. . . versatile, all-purpose

interchangeable components for Make-Up AIR

and general ventilation applications . . .

The Make-Up AIR, using Steelfin coil, now adds to its family a heating and ventilating unit, using Aerofin copper coil. All sections are individually supported, and are removable for maintenance or replacement. Nine basic blower sections are available, in any rotation. Write now for bulletin 567.

nyb **THE NEW YORK BLOWER COMPANY**

SALES OFFICES: 3149 SOUTH SHIELDS AVENUE • CHICAGO 16

No one wrench will meet all needs

15/16
MADE IN U.S.A.
1"

... the same is true of air filters!

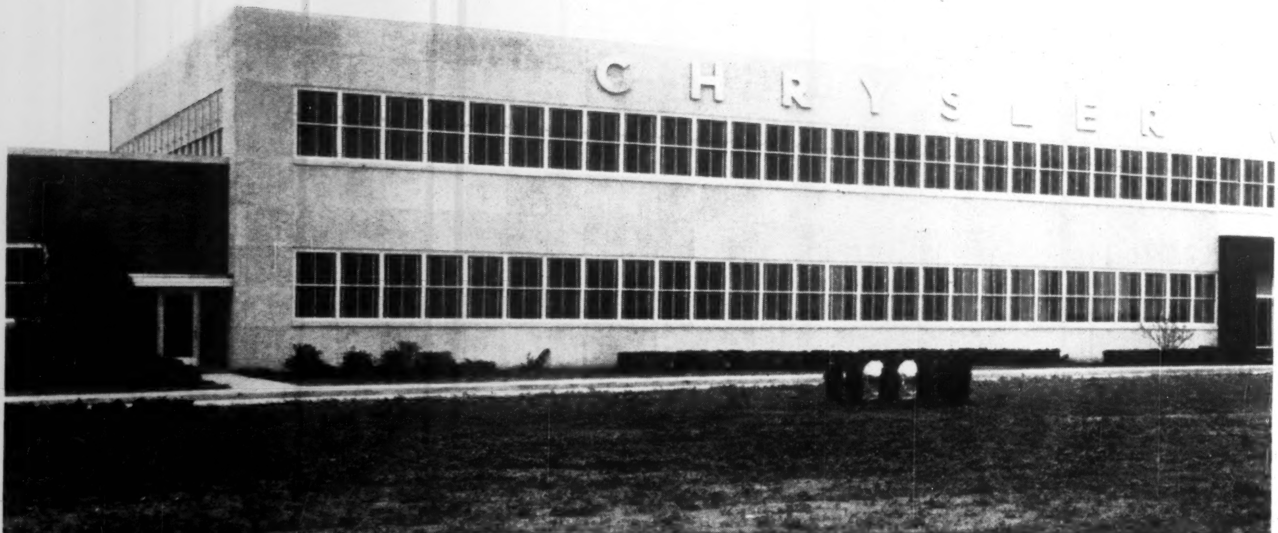
Air filters—like wrenches—must be made in a wide variety of types and sizes to meet differing requirements. No *one type* of air filter can meet all the clean-air needs of business and industry.

That's why AAF (and only AAF!) makes *all* types. No matter what your specific needs, AAF can provide the *cleaning efficiency you need* plus the *maintenance characteristics you want.*

Before selecting your filters, talk with the company that *offers* a selection. Let us show you how our complete-line approach assures you of the *right* air filter installation.

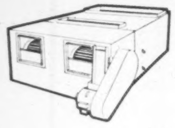
AAF herman nelson **American Air Filter**
COMPANY, INC.
373 Central Avenue, Louisville 8, Kentucky
American Air Filter of Canada, Ltd., Montreal, P. Q.

AAF MULTI-DUTY FILTERS CHRYSLER TRANSMISSION



Chrysler Torque Flite Transmission Plant, Kokomo, Indiana. Architects and Engineers: Albert Kahn Associated Architects and Engineers, Inc., Detroit, Michigan; Mechanical Contractor: Freyn Bros., Inc., Indianapolis, Indiana.

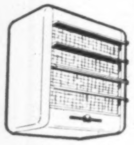
OTHER AAF EQUIPMENT INSTALLED AT KOKOMO PLANT



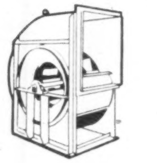
HEATING AND VENTILATING UNITS

UNIT BLOWERS

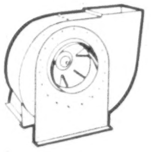
VERTICAL UNIT HEATERS



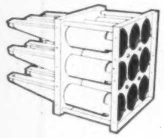
HORIZONTAL UNIT HEATERS



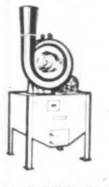
CENTRIFUGAL FANS



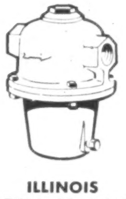
TYPE K EXHAUSTER



AMERclone DUST COLLECTORS

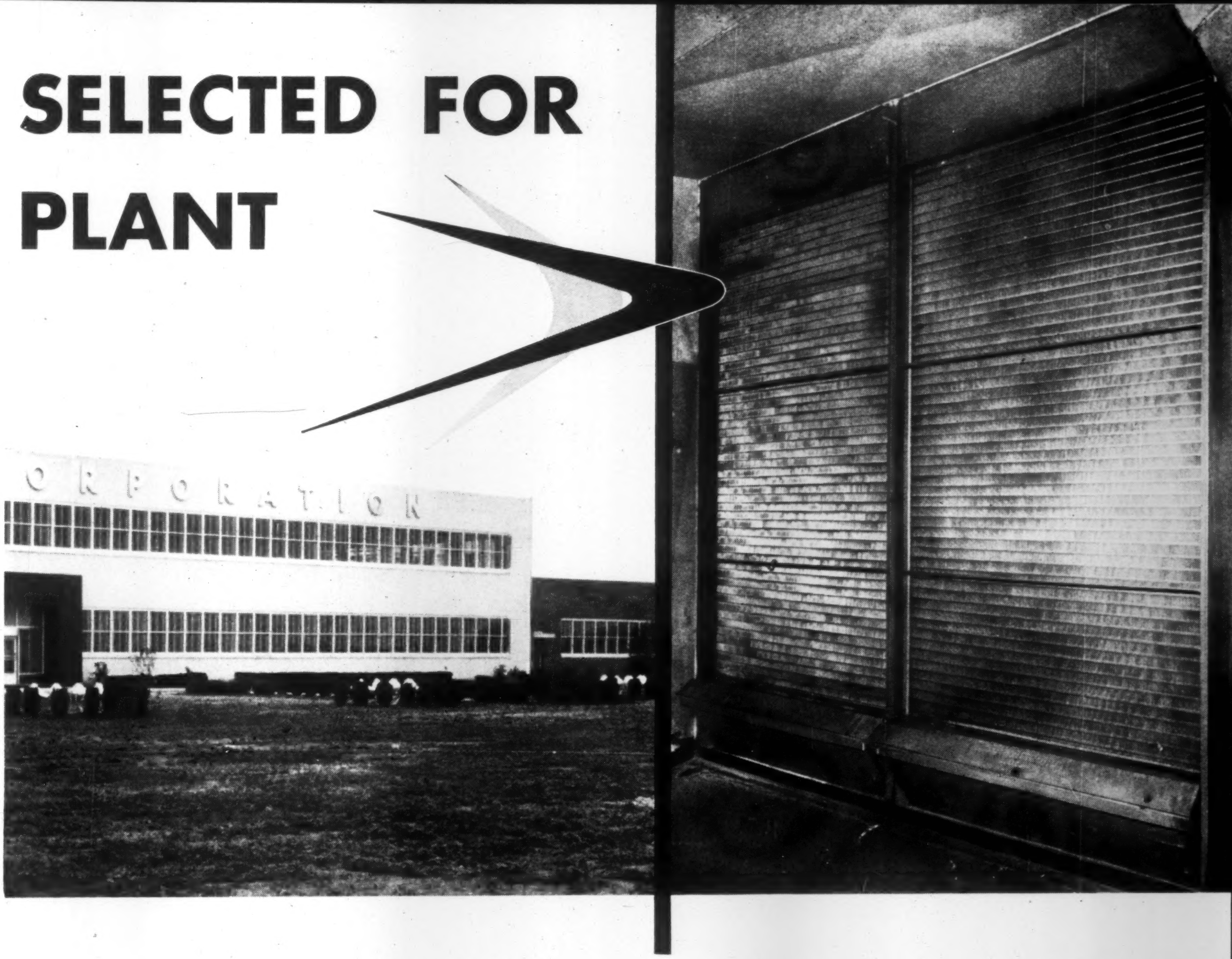


TYPE D ROTO-CLONE DUST COLLECTOR



ILLINOIS HEATING SPECIALTIES

SELECTED FOR PLANT



Self-cleaning filters supply 1,319,300 cfm of clean air to modern Kokomo plant

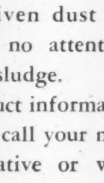
Clean air for ventilation was a major consideration when Chrysler Corporation planned its huge new Torque Flite automatic transmission plant at Kokomo, Indiana. Their filter selection is shown in the photograph above—one of *thirty-four* Multi-Duty installations.

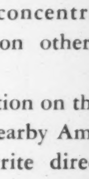
The Multi-Duty is a time-tested clean air veteran. Continuous, automatic cleaning of its filter curtain assures both constant efficiency and uniform air delivery, regardless of dust load. Operating resistance remains fixed when once established for a given dust concentration. Multi-Duty requires no attention other than periodic removal of sludge.

For complete product information on the self-cleaning Multi-Duty, call your nearby American Air Filter representative or write direct for Bulletin No. 241-E.

AAF American Air Filter
COMPANY, INC.
herman nelson
373 Central Avenue, Louisville 8, Kentucky
American Air Filter of Canada, Ltd., Montreal, P. Q.

AAF Dust Control Equipment

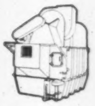


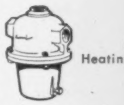


Illinois Heating Specialties

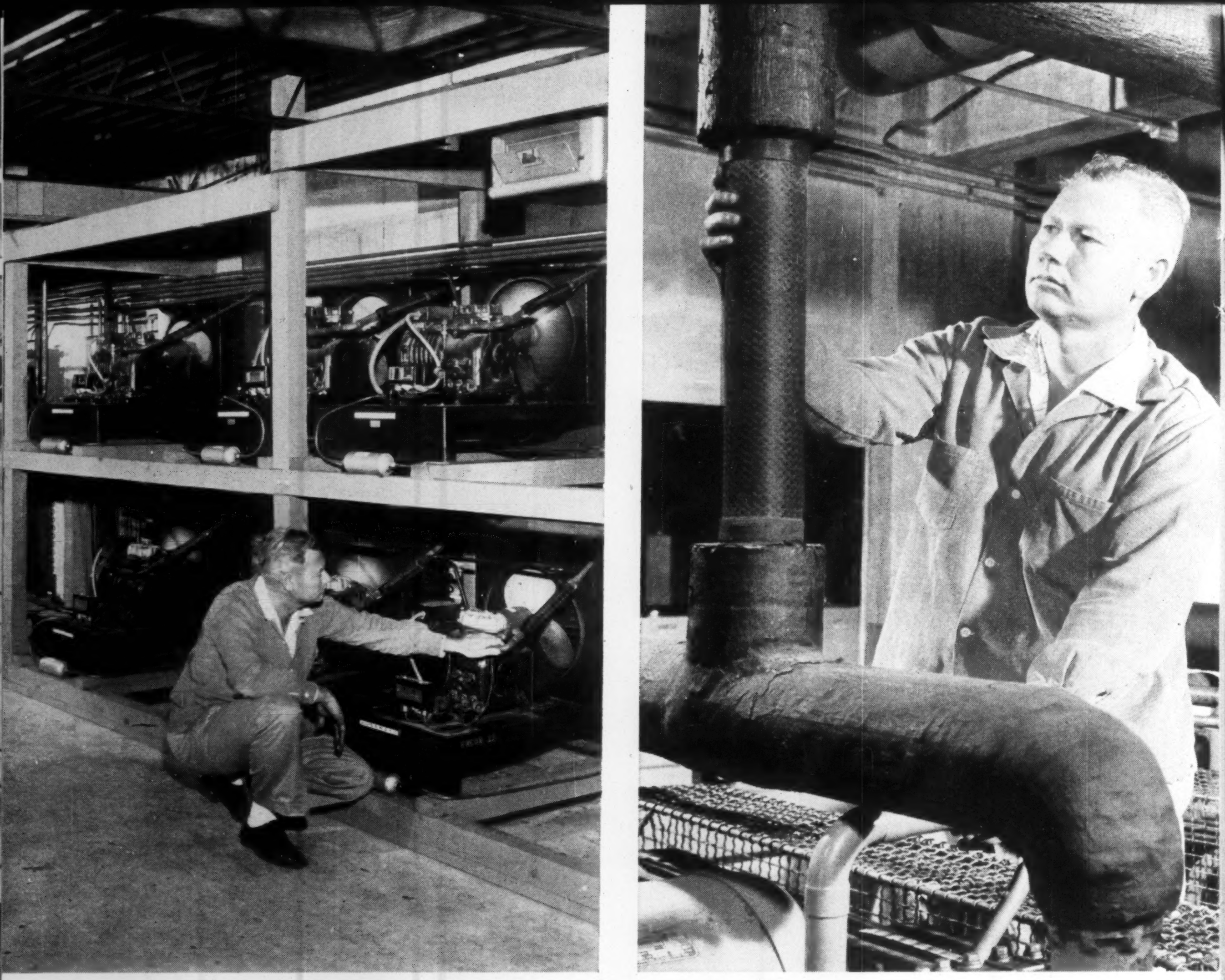
— BETTER AIR IS OUR BUSINESS —

Herman Nelson Unit Heaters





Herman Nelson Unit Ventilators



Mr. Crosson points to 1⅛" American VE's used on small compressors that service meat boxes, etc., and 2⅛" American VE's installed in suction and discharge lines of air conditioning units employing Freon 12, at Winn-Dixie food market—Kwik-Chek—in Sulphur Springs, Fla.

"American Vibration Eliminators have been good for millions of vibrations on our jobs—with no failures"

says James Crosson, Refrigeration Service Manager, Winn-Dixie food market chain, Tampa, Florida

"People would walk out of our food markets if the air conditioning broke down—and chances are they wouldn't come back. So we really *depend* on American VE's.

"In the 8 years we've used them, they've been good for millions of vibrations—with no failures reported and no maintenance needed. Without American VE's, we would have had solder joints breaking, loss of refrigerants, and other costly breakdowns."

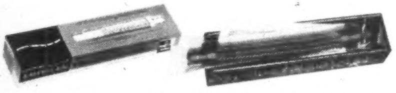
YOU CAN USE AMERICAN VE'S WITH CONFIDENCE BECAUSE—

The right metal does the job. The special tin-bronze alloy—the result of American Brass metallurgical know-how—is tailored for the refrigeration and air conditioning industries.

Double bronze braid where extra protection is needed. On all American VE's 2⅝" O.D. or larger. Neoprene latex-covered Vibration Eliminators are available for use when danger exists from condensed moisture on the outside of the VE.

Clean, dry, tested, protected. Snip the end of the vaporproof polyethylene bag and you have a factory-fresh unit to install in the line . . . clean, inside and out!

Packaged for your convenience, protection. The new boxes are sturdy, easy to open, easy to identify. No confusion or fumbling.



Listed by Underwriters' Laboratories through sizes 3⅝" O.D.

For descriptive folder write: The American Brass Co., American Metal Hose Division, Waterbury 20, Conn. In Canada: The Canadian Fairbanks-Morse Co., Ltd. 57207

WHEREVER CONNECTORS MUST MOVE

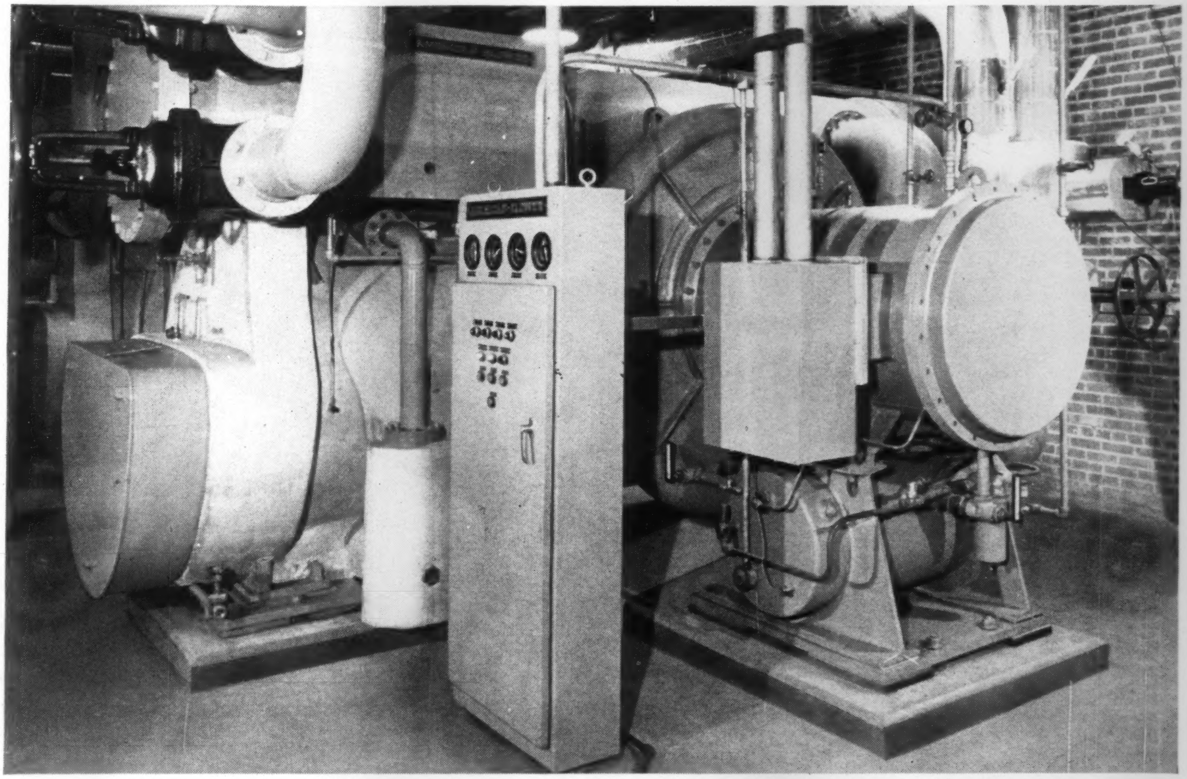
AMERICAN

FOR AMERICAN VIBRATION ELIMINATORS SEE YOUR

ANACONDA®

DISTRIBUTOR

AMERICAN BLOWER AIR CONDITIONING



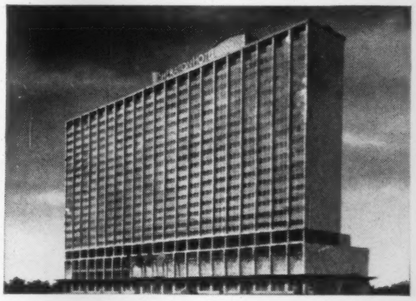
Two 350-ton American Blower Tonracs supply chilled water for the entire Sheraton air-conditioning system.

Tonrac®—heart of the air-conditioning system in Philadelphia's new Sheraton Hotel

To help extend a traditional Sheraton welcome to travelers in the City of Brotherly Love, engineers, builders and mechanical contractors selected two American Blower Tonrac Centrifugal Refrigerating Machines to supply the air-conditioning system in the new Sheraton Hotel.

They chose Tonracs on the basis of their high capacity; their quiet, vibration-free operation; and American Blower's engineering know-how and reputation as a leader in the air-handling and air-conditioning field. The Tonracs supply all the chilled water for 1,000 individual American-Standard Remotaire room units that air-condition 5,700,000 cubic feet of space.

When your client's plans call for air conditioning—call our nearest branch office for invaluable product information. American Blower Division of American-Standard, Detroit 32, Michigan. In Canada: Canadian Sirocco products, Windsor, Ontario.



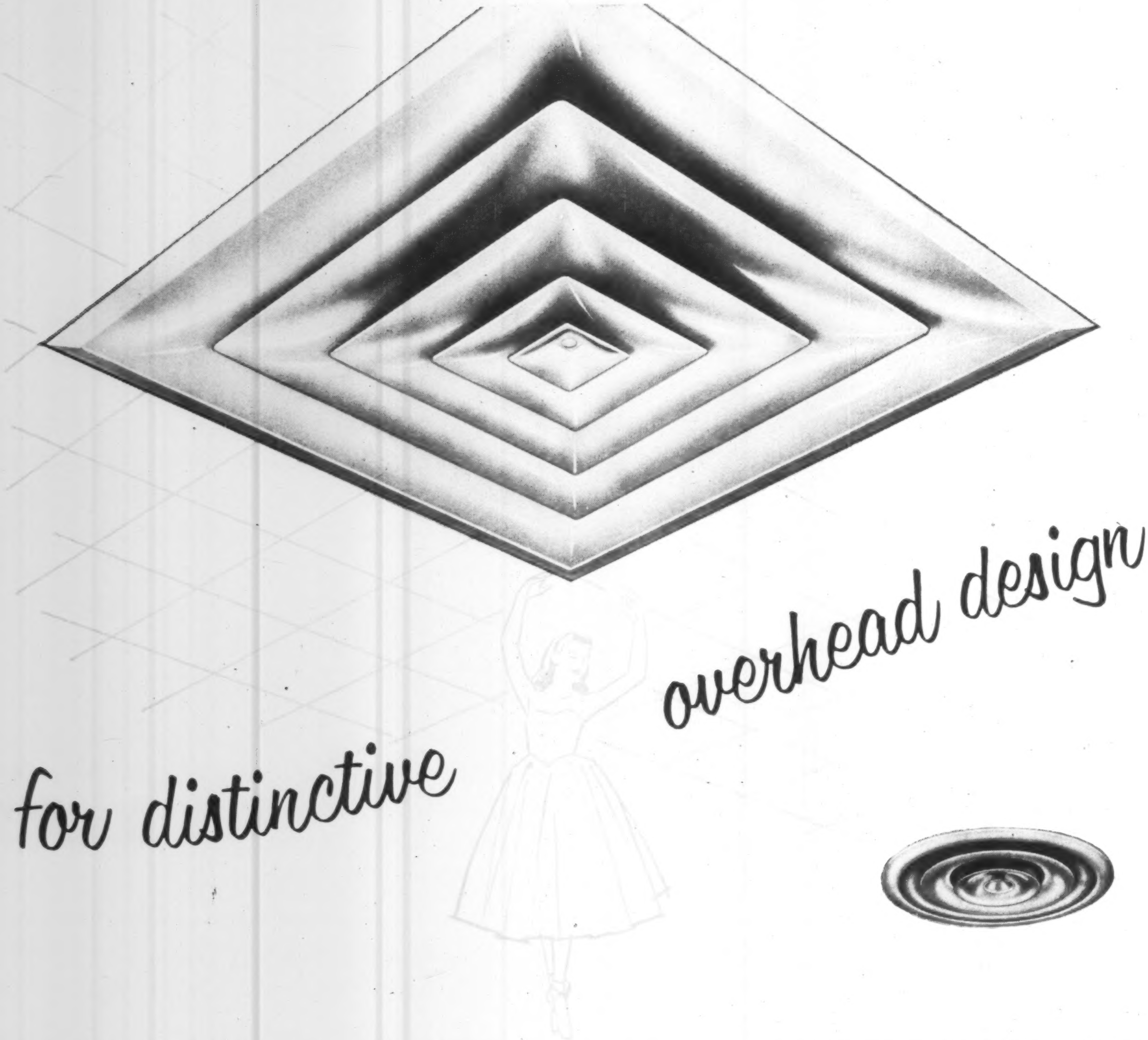
The 22-story Sheraton Hotel, Philadelphia. Tonracs, installed on the fourth floor, operate so quietly that guests on adjoining floors never hear a sound.

Building Credits
Architects: Perry, Shaw, Hepburn & Dean
Consulting Engineers: Slocum & Fuller
Builders: McCloskey & Co.
Mechanical Contractors: Ambrose-Augusterfer Corp.

AMERICAN BLOWER

Division of American-Standard

QUALITY PROTECTS YOUR INVESTMENT . . . American-Standard QUALITY IS AVAILABLE AT NO EXTRA COST



for distinctive overhead design

CEILING DIFFUSERS

designed by TITUS

SUPERB ULTRA MODERN STYLING

...These new ceiling diffusers give any room a dignified "room of tomorrow" look! All Titus ceiling diffusers—regardless of type—size—or shape—are so styled and proportioned that they blend harmoniously with each other and with room surroundings.

SUPERIOR DIFFUSION PERFORMANCE

...New exclusive *curved contour cone design*—plus extreme adjustability—make these outstanding precision air diffusion outlets EQUALLY EFFICIENT FOR HANDLING EITHER COOLED OR HEATED AIR.

UNIFORM APPEARANCE

...Regardless of air pattern setting—Titus Ceiling Diffusers always present a uniform appearance because 3 center cones move in unison and retain same relative position.

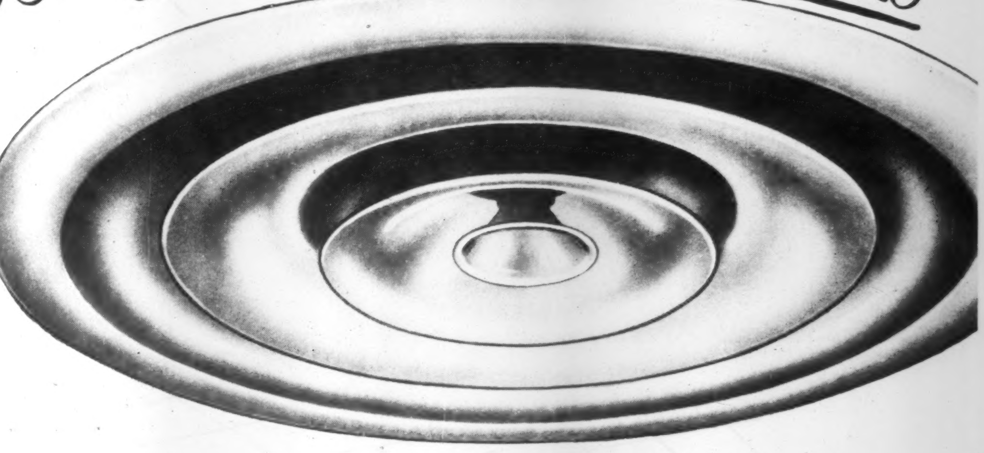
SIMPLE TO INSTALL-ADJUST

...Ingenious spring lock arrangement for quick, easy installation or removal—saves time and labor. Adjustable at the factory—or on the job. On Titus adjustable round diffusers, simply turn small center cone to adjust to any air pattern.

A COMPLETE LINE

...Titus Ceiling Diffusers are available in round, square and half round models in all standard sizes. Rigid steel construction—beautiful metalescent aluminum finish. Also a complete line of accessories—including ceiling cones, radial volume control dampers and plaster mounting rings.

...specify the New Complete Line



TODAY'S OUTSTANDING AIR CONDITIONING ACHIEVEMENT
FOR HANDLING OVERHEAD AIR *Gracefully* WITH PRECISION

FREE
CATALOG

ceiling diffusers
TITUS

TITUS MFG. CORP. WATERLOO, IOWA

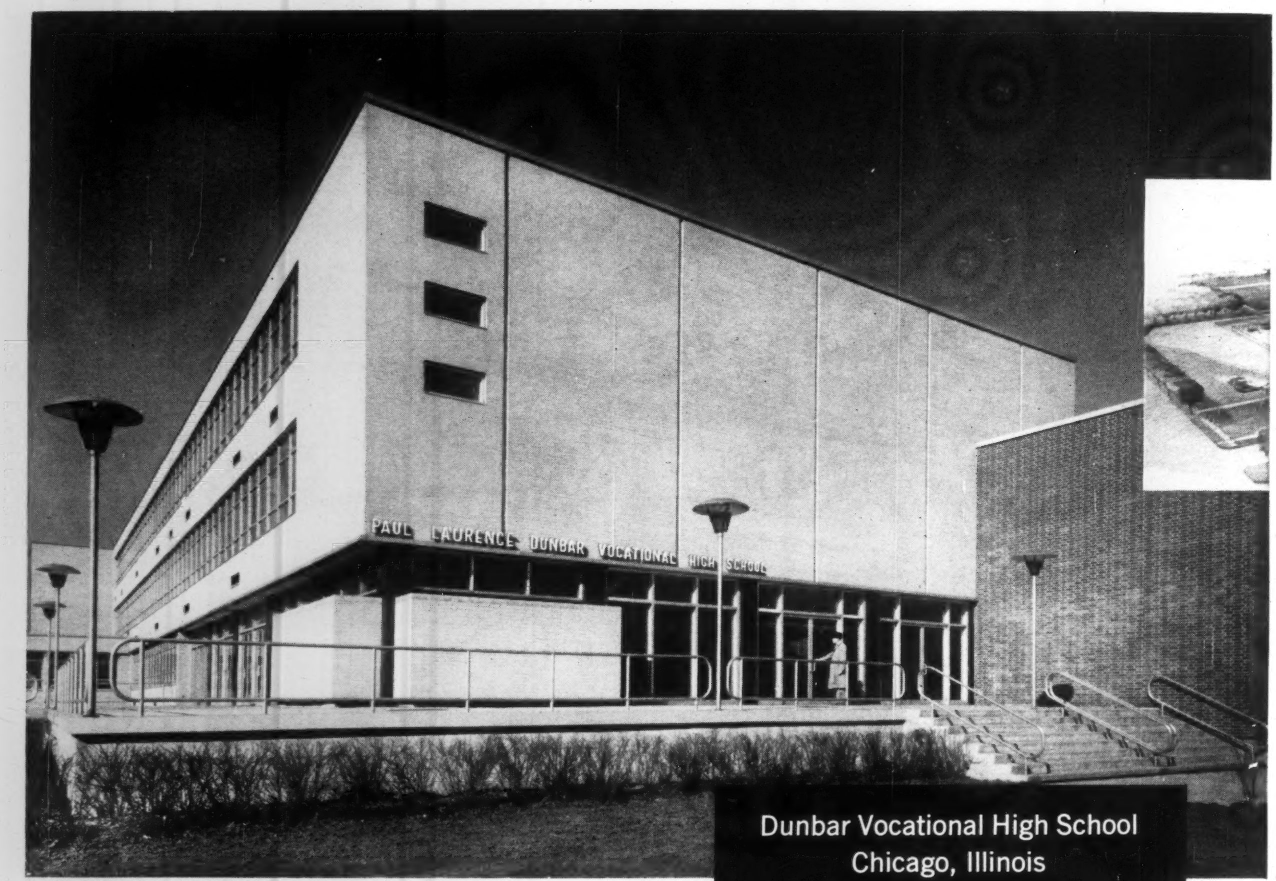
Gentlemen: I am interested in full details (engineering data, prices) on your new complete line of Ceiling Diffusers and Accessories. RUSH NEW, FREE CATALOG.

Name

Company

Address

City State



Photos: Hube Henry, Hedrich-Blessing

Dunbar Vocational High School
Chicago, Illinois

Entrance 3000 South Parkway

BENJAMIN C. WILLIS, General Supt. of Schools
EDWIN A. LEDERER, Associate Supt.
In Charge of Operation Services
JOHN C. CHRISTENSEN
Asst. Supt. in Charge of Architecture
HOLABIRD & ROOT & BURGEE
Associate Architects and Engineers
THOMAS J. BRETT
Asst. Supt. in Charge of Plant Engineering
JOSEPH J. DUFFY, General Contractor
WILLIAM ADAMS ENGINEERS, INC.
Heating Contractor
HUNTER CLARK VENTILATING SYSTEMS CO.
Ventilating Contractor

In the World's Largest Industrial Center, near the sites of Chicago's famous World's Fairs of 1933 and 1893, the $8,000,000 Dunbar School provides an efficient modern plant with the best equipment and instruction obtainable. It is coeducational and accommodates some 2300 day students. Night classes for adults are almost as large.

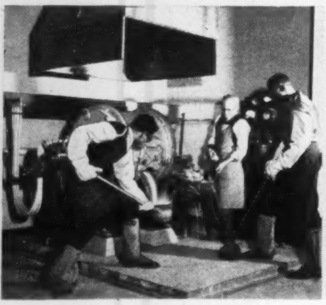
Students May Major in One of 27 Courses ranging from architectural and mechanical drafting, building trades and electronics to cosmetology (beauty culture), millinery and welding. All students are required to complete courses in English, science, mathematics, history and civics . . . the core of the curriculum.

Diverse Activities In This Outstanding School require different levels of thermal comfort for optimum efficiency of teachers and students.

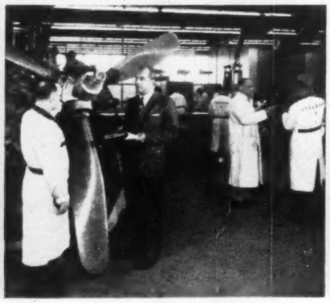
(c34)

Flexibility of a POWERS pneumatic control system → **provides each room with its proper temperature.**

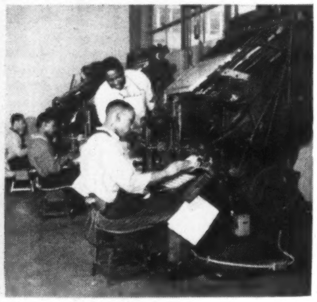
Foundry Practice, electric furnace



Aircraft Engine Mechanics

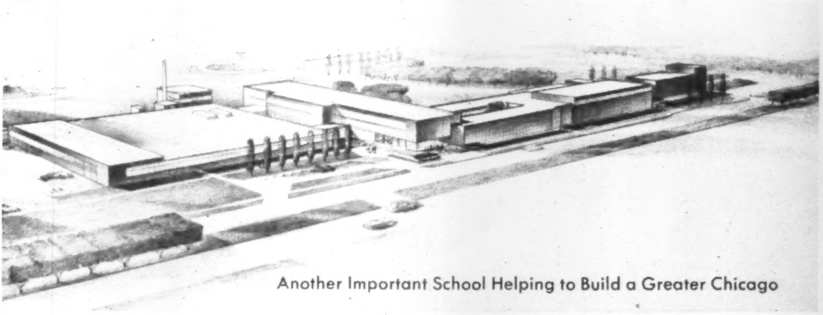


Mechanical Typesetting

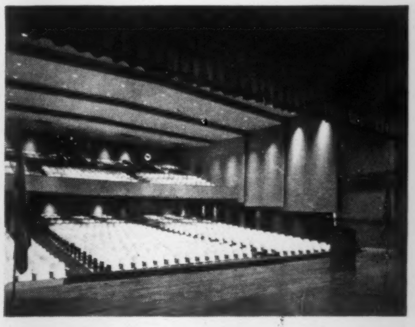


Chicago's new Dunbar Vocational High School

...offers students a bright future in the career of their choice



Another Important School Helping to Build a Greater Chicago



POWERS QUALITY System of Individual Room TEMPERATURE CONTROL

Provides Proper Thermal Environment for Learning

Dunbar is the Largest Chicago Public School built in the past decade. It consists of three buildings — a one story shop section; a three story classroom section; and a two story wing for auditorium, two gymnasiums, swimming pool and cafeteria. The latter section can be isolated for community use...Classrooms have unit ventilators. Central fan systems supply heating, ventilating and humidified air to auditorium, gymnasiums, natatorium and cafeteria. Eighteen boys shops are heated by unit heaters. These areas are also supplied with tempered fresh air to compensate for the exhaust systems. Interior shops are supplied by central fan systems ... all are Powers controlled.

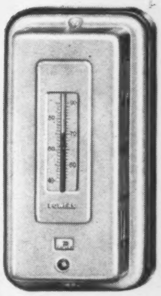
Are You Planning a New School? — Ask your architect or engineer to include a Powers engineered QUALITY system of pneumatic control. You'll insure utmost comfort at lowest upkeep cost.

For further information contact our nearest office

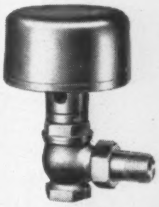
THE POWERS REGULATOR COMPANY

SKOKIE, ILL. | *Offices in Chief Cities in U.S.A., Canada and Mexico*

65 YEARS OF AUTOMATIC TEMPERATURE AND HUMIDITY CONTROL

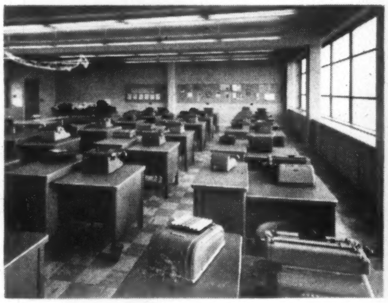


Powers Pneumatic Thermostats maintain set temperature day after day. They need no frequent checking or re-adjusting.

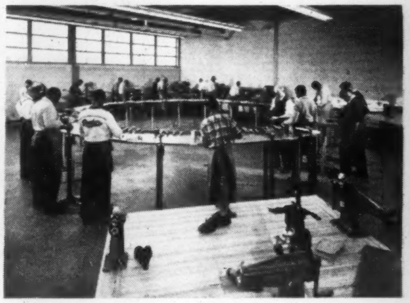


Powers PACKLESS Valves prevent water leakage, banish packing maintenance and give better control due to reduced valve stem friction.

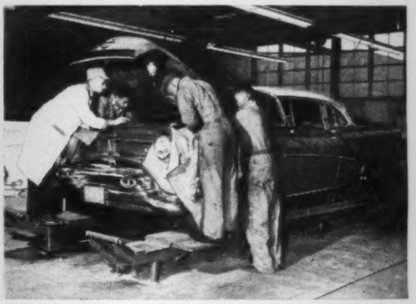
Office Practice Classroom



Shoe Rebuilding



Automotive Mechanics



Report No. 3 of a series

I was a slave to weather until I found

Kathabar® systems maintain spaces at 80 F and 55% RH, or lower, for processing, storage, and testing!

You can pick the best production weather you've ever had, and reproduce it every day of the year. You can set the exact storage temperatures and humidities which are ideal for your product. And in your testing lab, you can imitate any climate on earth.

All of this you can do economically with a Kathabar-engineered air conditioning system. In many applications, cooling can be accomplished with available water (e.g., a Kathabar system can reduce 72 F dew point air to 46 F dew point with 85 F cooling tower water). Refrigeration, when needed, is free to handle only sensible cooling with minimum tonnage and higher suction temperatures—without frost or duplicate coils. No overcooling or reheating necessary.

let's look [illegible]

This sampling of Kathabar installations will show you how effective and versatile a Kathabar system can be.

9 climates [illegible]

Candy's sold seasonally, but manufacturing economy demands uniform production throughout the year. A Chicago company uses Kathabar systems to store different types of candy in 9 separate zones. Humidities range from 12 to 50% RH; temperatures, 50 to 85 F.

zoned for profits

Another candy manufacturer spots individual Kathabar units and cooling units to fit the varied requirements of drying, chilling, polishing, coating, bottoming, packaging, storage, and comfort. One example of Kathabar-earned profits: polishing time cut in half.

ethical competition

In the high-volume, low-margin pharmaceutical industry, companies always seek new ways to reduce costs and improve quality control. One of the biggest companies achieves both with Kathabar systems in over 100 air conditioning zones. Outside weather can not interrupt processes. As a bonus, Kathabar systems deliver sterile air.

getting jets off the ground

The chemicals in solid rocket fuels are extremely hygroscopic, and must be dried before use. Kathabar systems protect their physical properties and insure accurate ballistic results. Process areas are maintained at precise conditions, even when hosed down frequently.

relieving printers' headaches

Kathabar systems keep printing papers from getting too wet or too dry; improve ink distribution and drying; eliminate the variables in plate-making. Printers earn new profits with more press time, fewer schedule upsets.

fast compressor assembly

Water vapor in a refrigerator compressor could cause obvious troubles. A Kathabar system enabled a large manufacturer to switch from batch to continuous drying—and cut production time, handling, and manpower.

who uses Kathabar systems

Kathabar systems make profits out of air for these industries:

Atomic Energy
Breweries
Cake Mix
Candy
Cellophane
Cellulose
Cereals
Chemicals
Coffee
Comfort
Compressors
Cookies
Electronics
Explosives
Film
Foundries
Gelatin
Glass
Glue
Gum
Hospitals
Hotels
Lacquer
Lenses
Machining
Matches
Marine
Meat
Offices
Ordnance
Paper
Pharmaceuticals
Plastics
Printing
Rockets
Rubber
Shellac
Sugar
Sanitaryware
Testing
Textiles
Transformers
Transistors
Vacuum Tubes
Varnish
Waterworks
Wire
Yeast

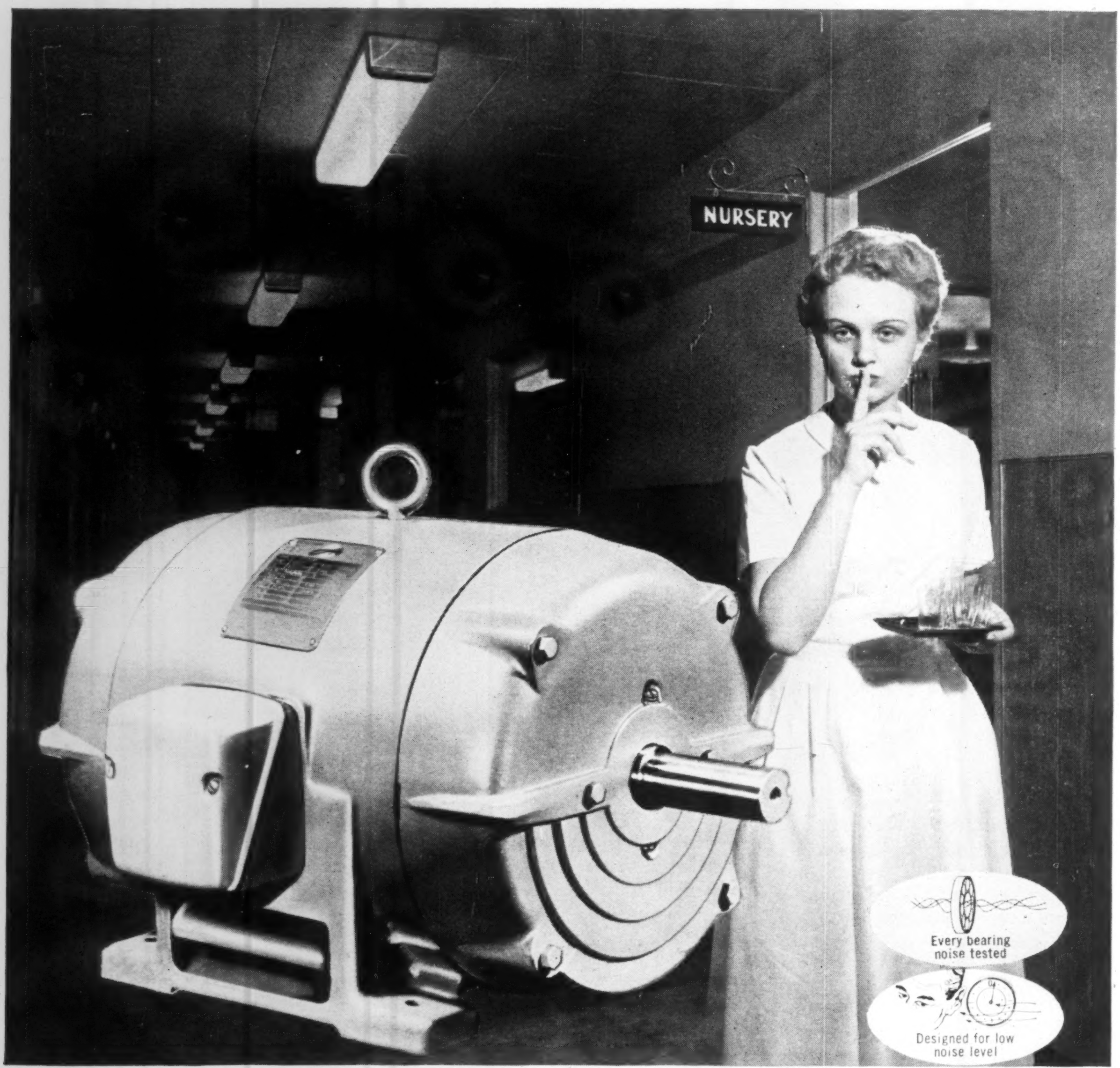
how they use Kathabar systems

Many of these industries use Kathabar systems to maintain spaces at 80 F and 55% RH or lower. Others use them to (1) obtain continuous air at sub-freezing dry bulb and dew points; (2) eliminate condensation; (3) deliver sterile air at specified dry bulb and dew point; and (4) improve drying processes.

send description of your problem

Air Conditioning and Drying Division
SURFACE COMBUSTION CORPORATION
2384 Dorr Street Toledo, Ohio

Kathabar systems by **Surface**



The motors with the built-in "hush"

Louis Allis designed them specifically for quiet operation

When you place an air-conditioning unit in close proximity to people, you must avoid disturbing noise characteristics.

In hospitals, nerve-racking resonance is therapeutically harmful. Even in less demanding installations like hotels and office buildings, silence is a prime specification for those concerned with guest comfort or increased worker efficiency.

Louis Allis motors are specifically designed for silent, vibrationless operation. Housings, bearings, end brackets are all thoroughly tested for *quietness.*

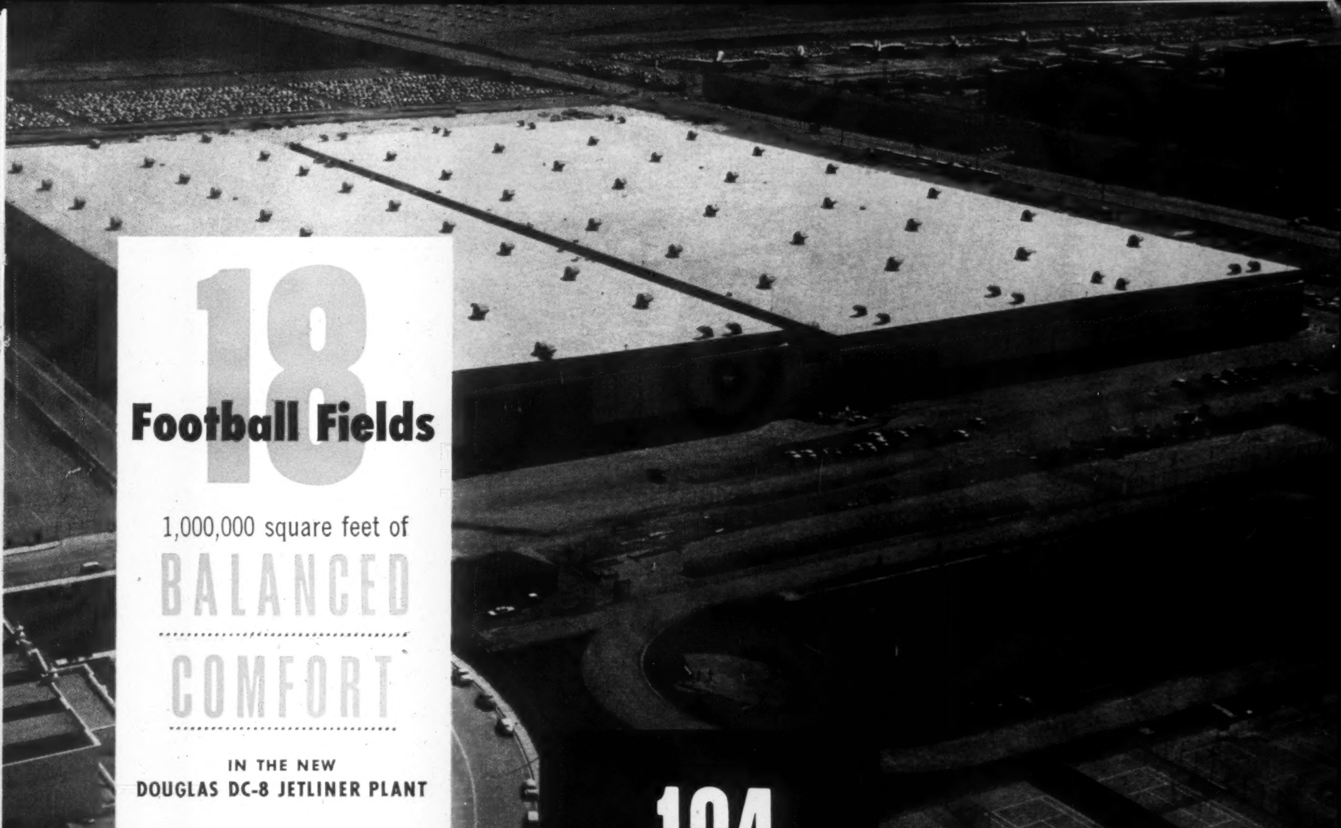
Result? A built-in "hush", particularly welcome in commercial installations.

Find out more about L. A. motors. Contact your nearby Louis Allis District Office, or write for our file-size Reference Bulletin 1700, "The New L. A. Line of Electric Motors." The Louis Allis Company, 453 East Stewart Street, Milwaukee 1, Wisconsin.

LA-112

LOUIS ALLIS

MANUFACTURER OF ELECTRIC MOTORS AND ADJUSTABLE-SPEED DRIVES



18 Football Fields

1,000,000 square feet of

BALANCED COMFORT

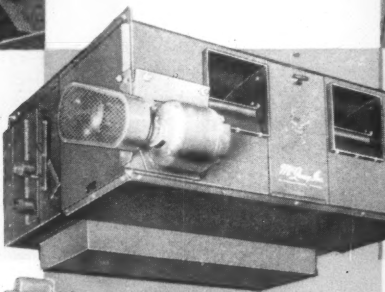
IN THE NEW
DOUGLAS DC-8 JETLINER PLANT

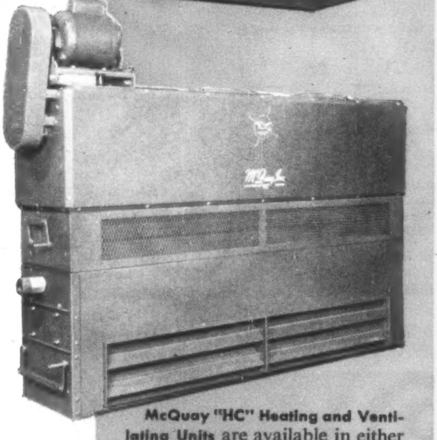
WITH 124
McQuay
HEATING AND
VENTILATING UNITS

New $20,000,000 Douglas Aircraft Company DC-8 Jetliner manufacturing plant, Long Beach, California.

Architects and Engineers	Holmes & Narver, Inc., Los Angeles, California
Mechanical Contractors	Southern Engineering & Construction Co., Inc., Long Beach, California

McQuay Means Quality





McQuay "HC" Heating and Ventilating Units are available in either horizontal (shown above) or vertical types (below) in 17 sizes with air deliveries from 1,280 cfm to 32,500 cfm, and capacities from 26,200 BTU/hr to 2,227,000 BTU/hr. There are four types with four or more fan discharge arrangements for each. Three types of coils are available—standard steam, jet tube steam or hot water, in both standard and heavy duty construction. A size and type for every job—each with all necessary accessories.

You may not have a million square foot job, such as the new Douglas Aircraft DC-8 Jetliner plant on your boards, but you will want to know that McQuay "HC" heating and ventilating units can handle and can produce balanced comfort over a large area—economically and practically. In the case of this Douglas plant, there are 124 McQuay HC-323 units.

The units are designed for use with high-pressure, high-temperature water, the temperature ranging from 210° F. to 400° F. with corresponding pressures.

The units are mounted at 56 foot elevation and strategically located to insure a 25 f.p.m. air motion at a 6 foot elevation.

Universal nozzles helped considerably in balancing the job by giving the desired air distribution over the entire floor area.

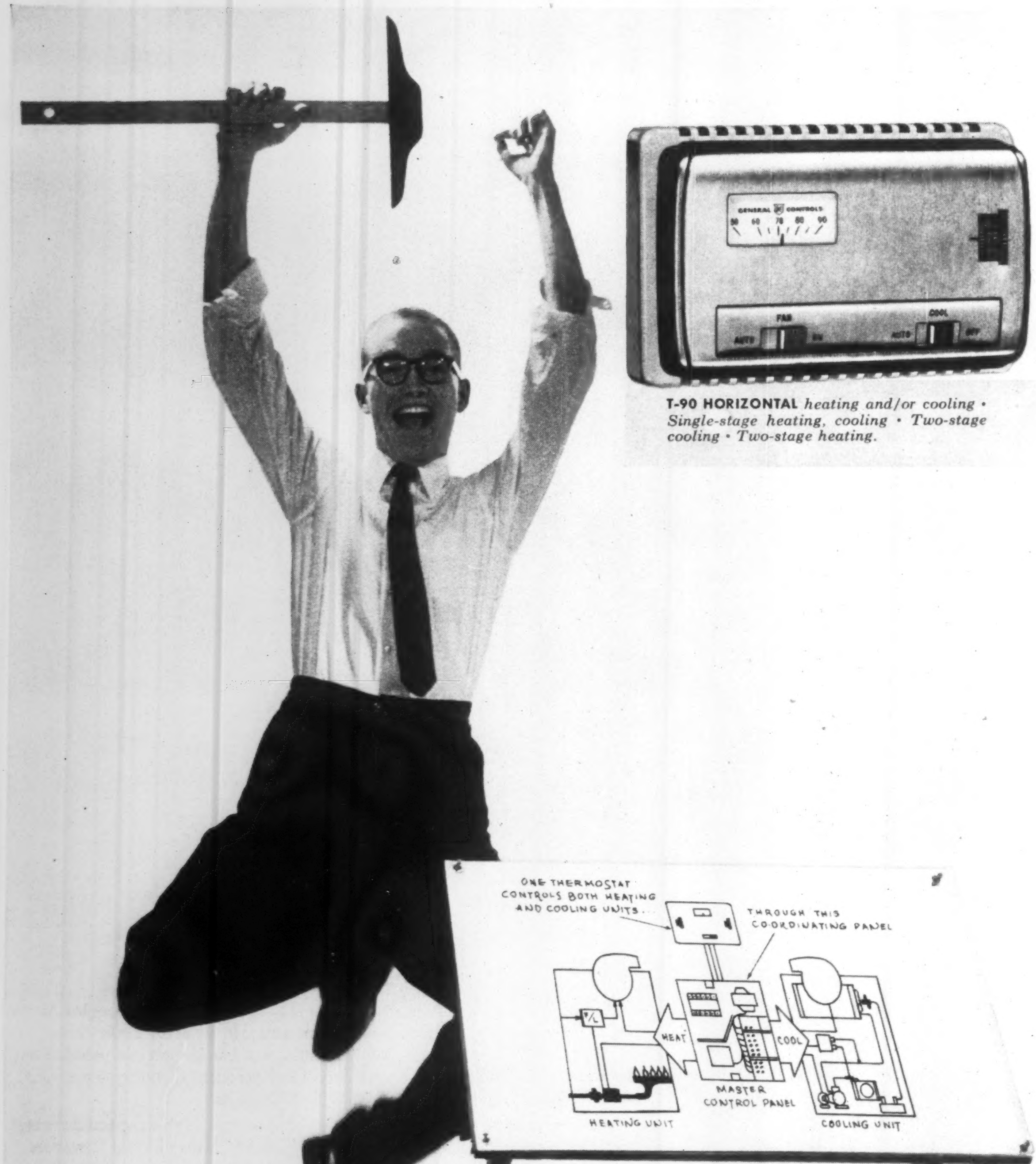
These versatile and flexible McQuay units can do the same for you on any job. Call in the McQuay representative near you.

McQuay INC.

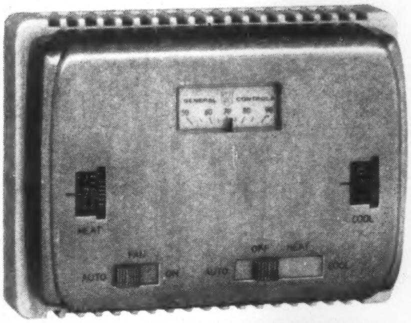
MAKE THE SEASONS COME TO YOU

1601 Broadway St. N.E., Minneapolis 13, Minnesota

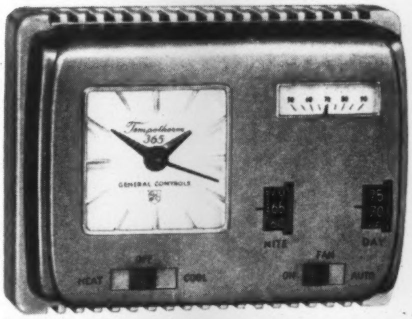
REFRIGERATION
HEATING
AIR CONDITIONING


GENERAL CONTROLS
50 60 70 80 90
FAN
AUTO ON
COOL
AUTO OFF
ONE THERMOSTAT CONTROLS BOTH HEATING AND COOLING UNITS...
THROUGH THIS CO-ORDINATING PANEL
HEAT
COOL
MASTER CONTROL PANEL
HEATING UNIT
COOLING UNIT

T-90 HORIZONTAL *heating and/or cooling • Single-stage heating, cooling • Two-stage cooling • Two-stage heating.*



T-240G YEAR-ROUND AIR CONDITIONING • *Flexible • Manual and automatic • Single unit changeover • Two-stage heating • Two-stage cooling.*



T-271 TEMPOTHERM *"365" • Electric clock day-nite air conditioning thermostat • Night temperature control improves humidity and provides cooling storage effect.*

LET YOURSELF GO!

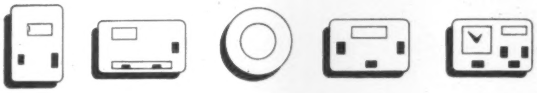
Here's General Controls with the answer to DESIGN FREEDOM IN AIR CONDITIONING. Give your systems engineers the green light. No need now (or tomorrow) to concern yourself with the automatic function of the system you envisage—whether it's gas, oil, coal, electric refrigeration, evaporative, chilled water and heat pump. General Controls *already* has the air conditioning thermostat that's by far the finest ever provided. You have a selection of over 118 function variations for the control of any system—automatically *and* reliably.

TAKE A LOOK AT VERSATILITY • Cool, heat, fan, auto, off, reset switching functions • Heating or Cooling—two or single stage • Heat-Cold anticipation • Day-Night Clock Programing • Single or Dual Dial Temperature Selection • Manual or Automatic change-over—

AND ALL FEATURE THE MERCURY SWITCH.

A COMPLETE PACKAGE WITH THE RP MASTER CONTROL PANEL

Here's a system combining all electrical elements necessary for full automatic refrigeration or year-round air conditioning. A compactly engineered pre-wired combination of all heating-cooling controls... motor relays, transformer, and pressure switches. Simple installation. Pre-wired to easily accessible terminal strips. One connection to either gas or oil fired heating units... interchangeably. High voltage terminals isolated, relay rating up to 5HP single phase, or 10HP, three phase. Permits use of high response voltage thermostats.



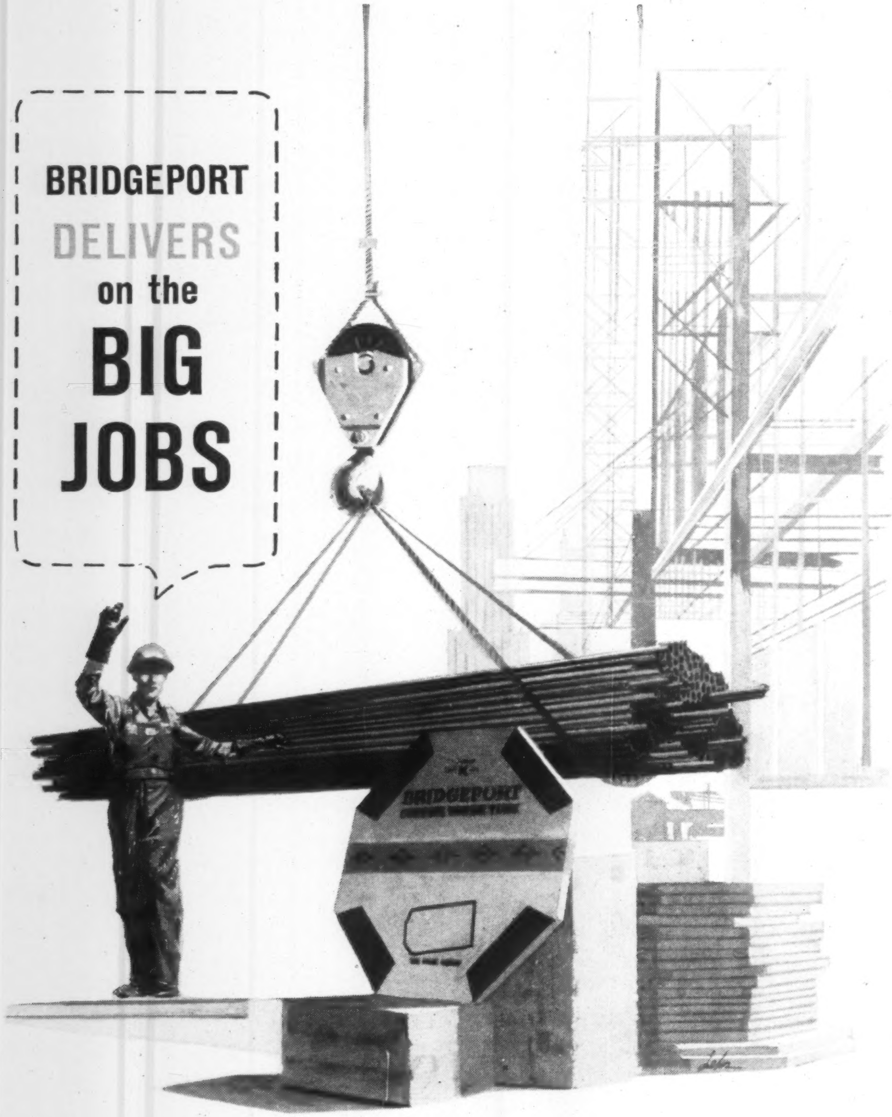
5 basic styles harmonize with any architectural or decorating theme.

GENERAL CONTROLS

America's Finest Automatic Controls for Home, Industry, and the Military

Glendale, California • Skokie, Illinois

Five Plants—42 factory branch offices serving the United States and Canada

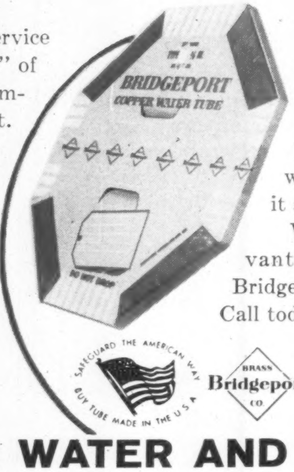


Here you see the job-site result of what national service means—Bridgeport's nationwide "supply network" of wholesalers, mills, warehouses and sales offices combining to insure big job delivery, when *you* want it.

What you can't see is the predelivery preparation that's yours when you specify "Bridgeport" for copper water tube, copper drainage tube, copper refrigeration tube and plumbing brass goods.

Your factory-trained Bridgeport salesman is a major part of Bridgeport's predelivery service. Through him you get Bridgeport's outstanding technical assistance. Bridgeport laboratories, sales metallurgists, and corrosion engineers are always ready to help you choose, help you solve, help you *make sure* that what's delivered for the big job will make it a *better* job.

Why not put Bridgeport on-the-site advantages to work for you? Your nearby Bridgeport Sales Office is the place to begin. Call today.

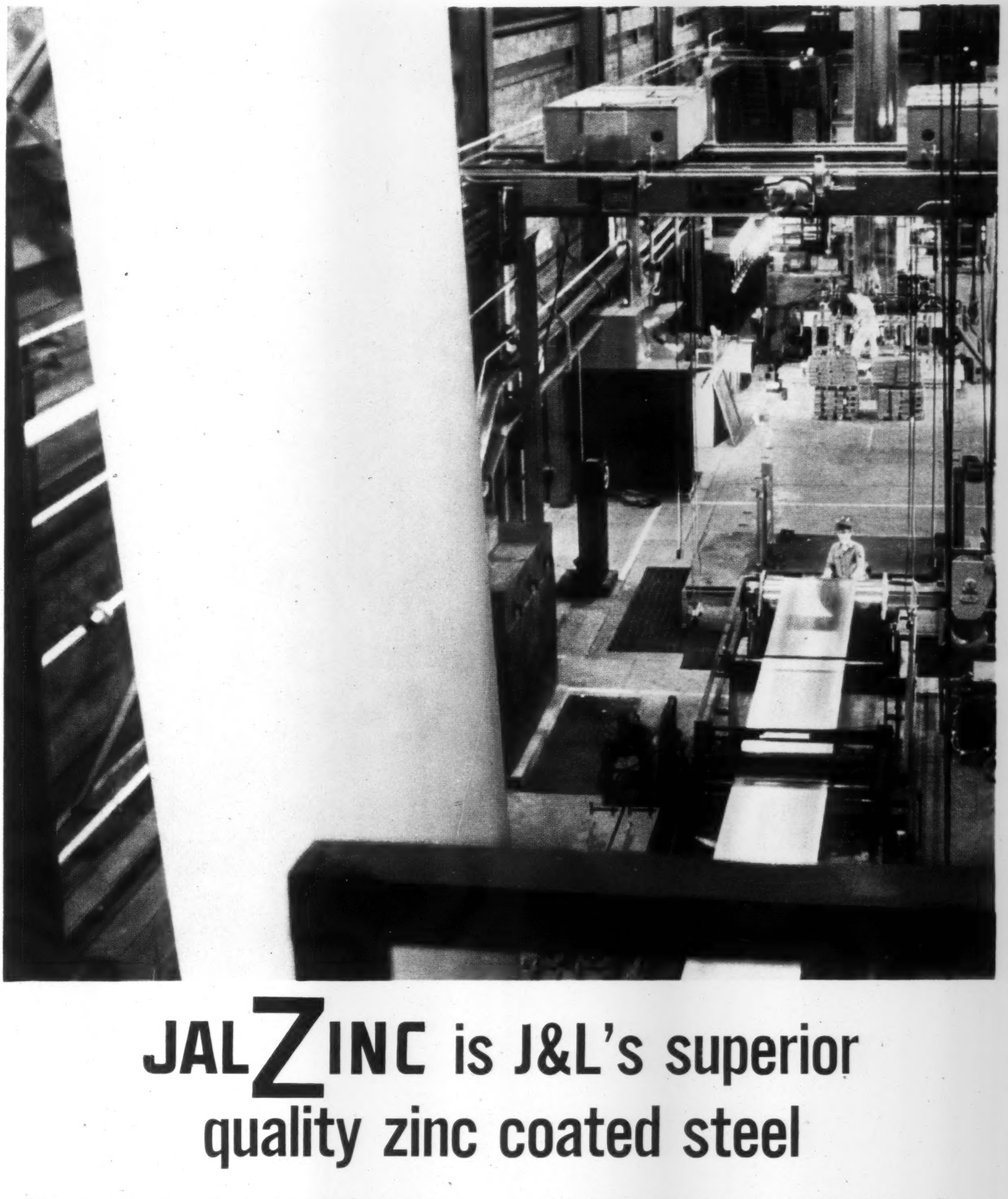


SAFEGUARD THE AMERICAN WAY
BUY TUBE MADE IN THE U.S.A

BRASS
Bridgeport
CO

BRIDGEPORT COPPER WATER AND DRAINAGE TUBE

Bridgeport Brass Company, Bridgeport 2, Conn. • Offices in Principal Cities In Canada: Noranda Copper and Brass Limited, Montreal



JALZINC is J&L's superior quality zinc coated steel

JalZinc is produced on this modern Sendzimir continuous galvanizing line. JalZinc has a tight, uniform coating that resists cracking and flaking. The uniform ductility, flatness and a high luster surface finish improve your product appearance.

JalZinc is available in a wide range of gages and widths in both cut lengths and coils. It can be furnished in coating weights from 1.00 oz. to 2.50 oz. per sq. ft., depending on your end product needs.

Get details from your local J&L district office or write to the Jones & Laughlin Steel Corporation, Dept. 518, 3 Gateway Center, Pittsburgh 30, Pa. For out of stock requirements, call your local steel warehouse or sheet metal distributor.

J&L STEEL

Jones & Laughlin

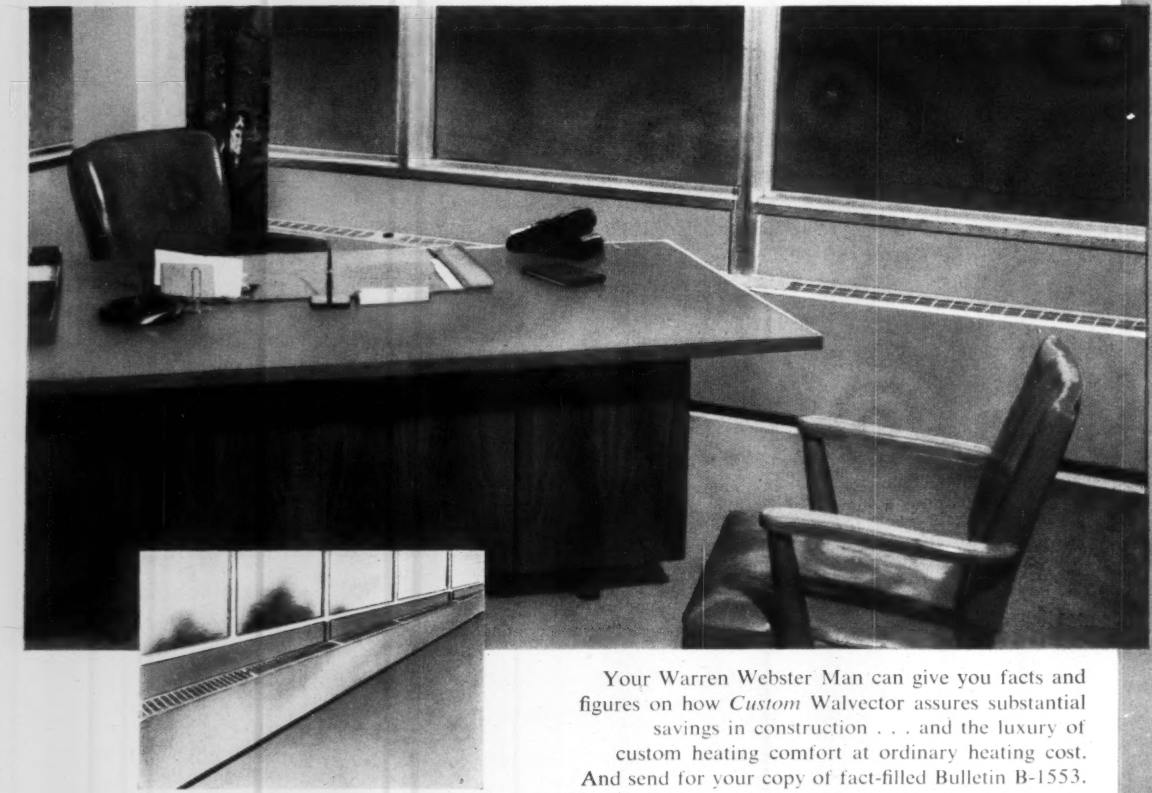
. . . a great name in steel

CUSTOM WALVECTOR *for Perimeter Heating*

NEW
Heating Comfort
NEW
Building Economies

Custom Webster Walvector, for Tru-Perimeter Heating with steam or hot water, is the modern comfort-heating that's designed into a building at the blueprint stage. Integrated with the structure itself, it assures proven heating comfort . . . worthwhile savings in building costs.

Architects and engineers are using *Custom* Walvector to end the need for finishing walls beneath windows, to provide integral sills, and to enhance the attractiveness of commercial or institutional interiors. Time-proved Walvector heating element provides gentle, uniform warmth. Wide variety of enclosure types and grille arrangements match every design need. Special metal gauges and colors available.



Custom Webster Walvector provides the beauty and comfort of Tru-Perimeter Heating at National Headquarters of Medusa Portland Cement Company, Cleveland, Ohio. Architect: Ernst Payer. Engineer: Howard Bennett & Associates. Heating Contractor: Burens Heating & Ventilating Company. General Contractor: Brown Construction Company.

Your Warren Webster Man can give you facts and figures on how *Custom* Walvector assures substantial savings in construction . . . and the luxury of custom heating comfort at ordinary heating cost. And send for your copy of fact-filled Bulletin B-1553. Warren Webster & Company, Camden 5, New Jersey. Since 1888. Offices in 69 principal U. S. cities. In Canada, Darling Bros., Ltd.

Webster's Finest Product . . . the Warren Webster Man

WARREN WEBSTER

HEATING . . . COOLING

They're building reputations installation by installation!

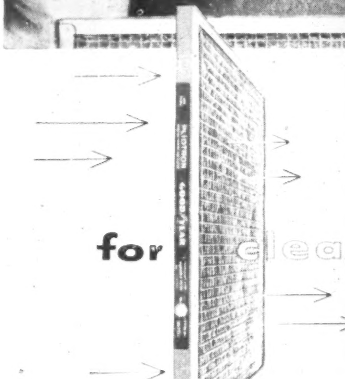
No question about the success of this filter installation in a large, modern bakery. It does a better job of filtering air to the cooler—taking the heat off 100,000 loaves of bread a day on their journey from oven to wrapper. And it saved the user a projected 70% of his "normal" annual filter costs.

Naturally, this reflected plenty of credit on the men who recommended and installed PLIOTRON super-filters. Customers are always quick to appreciate work that saves them time lost in premature replacements. And usually they pass on their satisfaction—in more business and valuable word-of-mouth advertising.

When you install PLIOTRON, they have plenty to talk about, too: It captures up to 5 times as many fine dirt particles as ordinary filters. Since it's a depth-loader—not a surface-loader—it works efficiently far longer between cleanings. And when dirty, a quick bath restores its full efficiency.

So it's easy to see why users are willing to pay the extra initial cost of PLIOTRON filters. And these super-filters boost the reputation of everyone who recommends them—installation after installation. For details, write:

Goodyear, P.O. Box 288, Akron, Ohio.



for cleaner air everywhere—

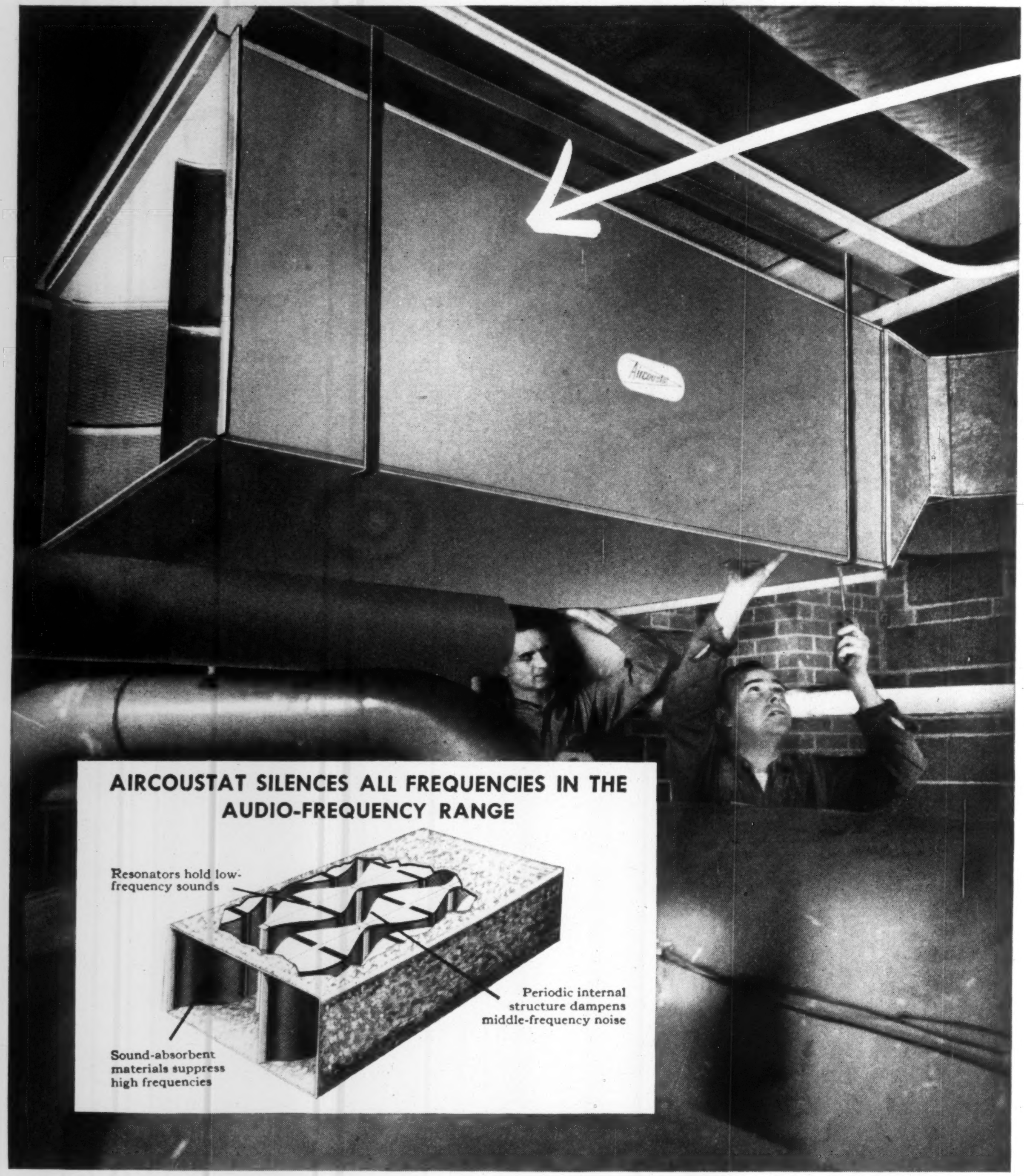
PLIOTRON AIR FILTER BY

GOODYEAR

THE GREATEST NAME IN RUBBER

Pliotron—T. M. The Goodyear Tire & Rubber Company, Akron, Ohio

AIRCOUSTAT* sound traps layout for controlling


Aircoustat

AIRCOUSTAT SILENCES ALL FREQUENCIES IN THE AUDIO-FREQUENCY RANGE

Resonators hold low-frequency sounds
Periodic internal structure dampens middle-frequency noise
Sound-absorbent materials suppress high frequencies

simplify design and air conditioning noise

THIS 5-FT. AIRCOUSTAT REPLACES 80 FEET OF ORDINARY DUCT LINING

AIRCOUSTAT saves you time on the job because it's pre-engineered . . . and fits acoustically if it fits geometrically. AIRCOUSTAT is quick and easy to install . . . no special tools are required.

Most Efficient Solution

AIRCOUSTAT's power to deaden sound is unmatched by other sound control methods devised for air conditioning systems. Acoustical performance is *guaranteed.* Efficiency is more than 13 times that of ordinary lining. And AIRCOUSTAT provides a lower flow resistance and less pressure drop than other sound control methods.

AIRCOUSTAT suppresses sound in low-velocity air conditioning systems . . . will silence an entire system or selected outlets. AIRCOUSTAT units fit any size of duct within the range of unit sizes . . . adapt themselves to any shape of duct.

Cost You 50% Less

AIRCOUSTAT units cost you as much as 50% less than ordinary duct lining . . . with savings in time and labor costs. AIRCOUSTAT is quick and easy to install . . . no special tools are required. You can ship ducts nested together and store them outside on the job site.

Apply Anywhere

AIRCOUSTAT eliminates noise in a wide range of applications: general and private offices, conference rooms, sleeping quarters, and recording studios.

Born of the Jet Age

Koppers' amazing new AIRCOUSTAT is the product of years of experience in designing sound control installations for aviation and other industries. Jet engine housings, machine enclosures, sound barriers and traps, sound-proof foremen's offices—these are only a few of the many sound control devices created by Koppers Industrial Sound Control engineers. Koppers has put this engineering "know-how" to work silencing air conditioning noises more effectively . . . more economically than was ever before possible . . . saving you time and costs.

For more details, write to KOPPERS COMPANY, INC., Industrial Sound Control Dept., 6209 Scott Street, Baltimore 3, Maryland.

**Koppers Trademark*

KOPPERS

INDUSTRIAL SOUND CONTROL

Engineered* Products Sold with *Service

BETTER AIR CONDITIONING FOR EVERYBODY EVERYWHERE
Carrier

Which is the best way to air condition an existing building?

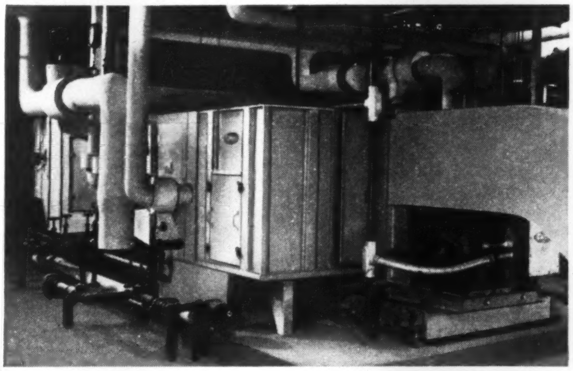
That depends on the building. Its age, size, construction and available power facilities are all important. They affect the selection and location of individual room outlets, central air conditioners and refrigerating machines. Carrier, in its famous Modular Weathermaster* System, offers many choices of these three basic components. Some are shown on the opposite page. Each provides unique advantages under special conditions. With these choices and many more, Carrier can recommend impartially the best air conditioning for any building—a system that's economical, efficient and can be installed with a minimum of interference to a building's routine. For complete information, call your nearest Carrier office. Or write Carrier Corporation, Syracuse, New York.

AIR CONDITIONING OUTLETS

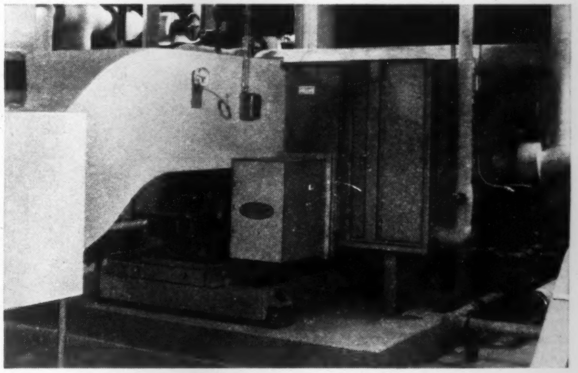
For conventional windows, Carrier Modular Weathermaster Units adapt to all types of wall and column construction. Based on the "building block" principle, they can be tailored for column-to-column treatment, corner assembly and a wide variety of other arrangements.

For windows with low sills, Carrier Modular Weathermaster Units provide a "foot-high" column-to-column arrangement that is very flexible and blends well with modern architecture and furnishings. Carrier Modular Units furnish individual control of room temperature.

CENTRAL AIR CONDITIONERS

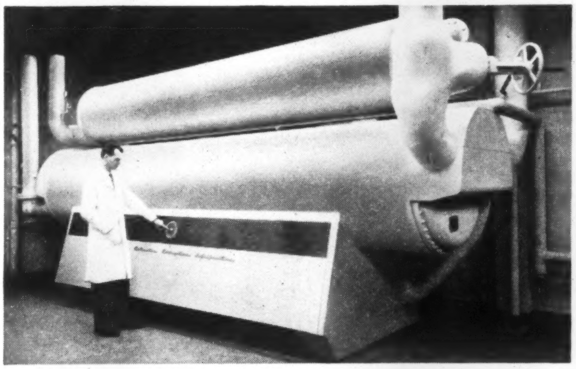


For buildings with multi-room perimeters and extensive outside exposure, this high-velocity, high-pressure, spray coil air conditioner supplies properly conditioned air for close humidity control through slim conduits to Weathermaster Units or other terminals 6500 to 21,000 cfm.

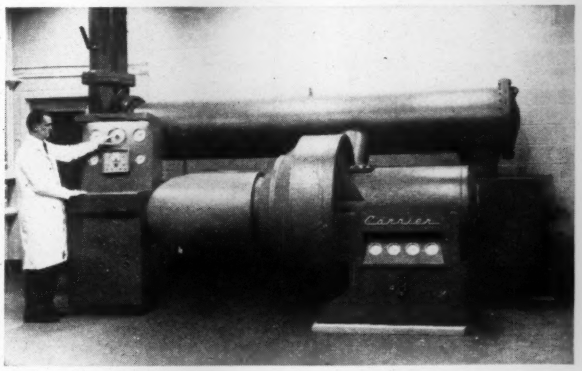


For buildings with large interior areas and relatively stable air conditioning requirements, this high-velocity, high-pressure, dry coil air conditioner is best. Conditioned air is distributed through slim conduits to ceiling or wall outlets. Capacities from 6500 to 23,000 cfm.

REFRIGERATING MACHINES



For operation with low-cost steam, Carrier's new Absorption Refrigerating Machines provide an economical source of chilled water for the air conditioning system. They cool water by using heat energy from low-pressure steam or hot liquids. Cooling capacities: 60 to 700 tons.



For operation with low-cost power, new Carrier Hermetic Centrifugal Refrigerating Machines feature a refrigerant-cooled motor, hydraulic-powered capacity vanes and electronic self-contained controls for completely automatic operation. Capacities: 90 to 1000 tons.

*Reg. U.S. Pat. Off.

THEY CHANGE THEIR OWN FILTERS–AUTOMATICALLY!

HERMAN NELSON

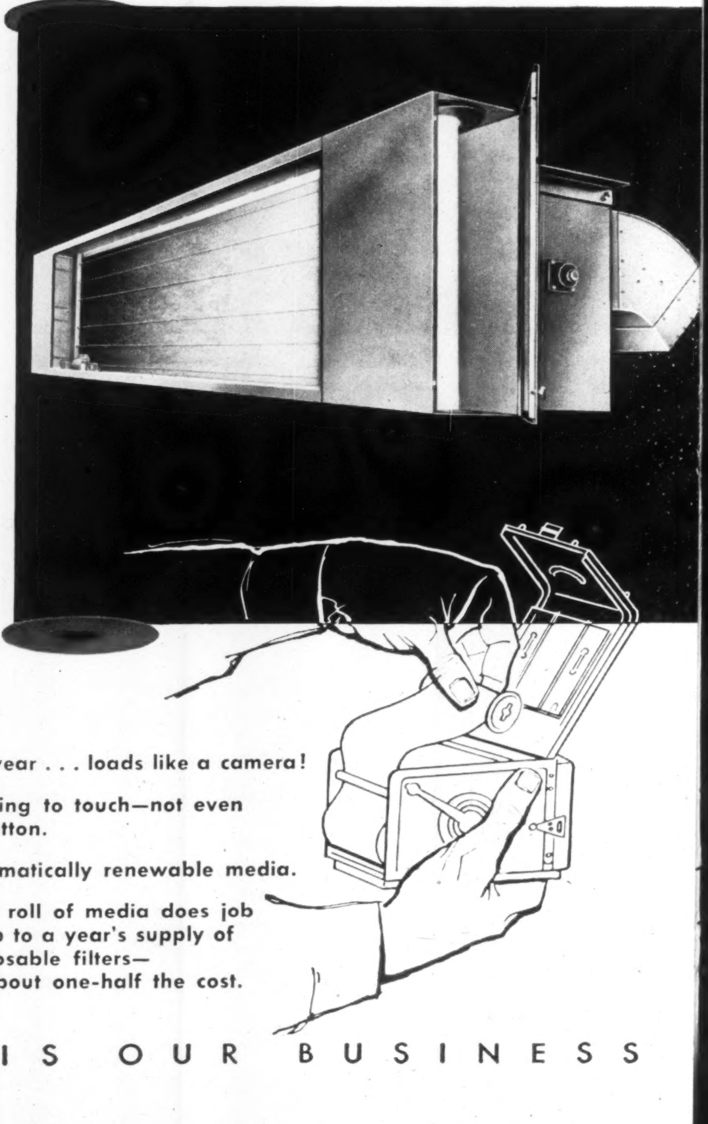
ROLL O VENT

AIR HANDLING UNITS

NEW, COMPLETELY AUTOMATIC IN OPERATION, the exclusive AAF Roll-O-Matic Air Filter Principle is now available on three leading Herman Nelson ROLL-O-VENT air handling units. You simply put the roll of media in the unit—*and forget it*—for up to a year! Operation is completely automatic, and under normal conditions costs just half that of ordinary disposable filters.

You gain maximum filtering efficiency *all year 'round*—with little or no maintenance. There is no reduction of efficiency in the system due to clogged filters. Furthermore, the system is always in balance—air flow *constant*—because clean media is automatically changed at just the right time!

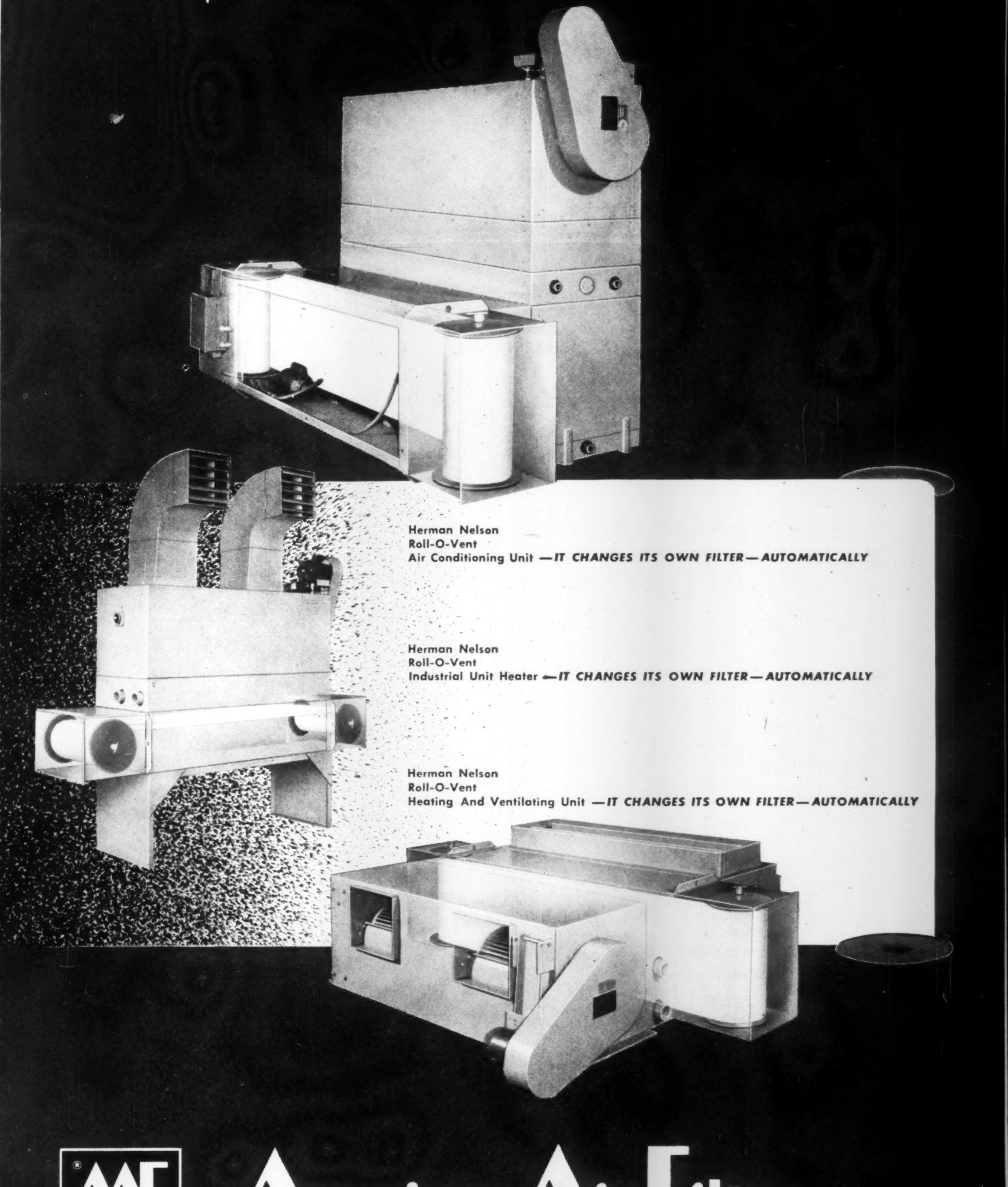
Take advantage of the important time and cost-saving features provided by this exclusive AAF development. Write for full details on "packaged" Herman Nelson ROLL-O-VENT heating, ventilating and cooling units. Ask for fact-filled Bulletin 780. Address Dept. 373.



One roll of media lasts up to a year . . . loads like a camera!

- **Nothing to touch—not even a button.**
- **Automatically renewable media.**
- **Each roll of media does job of up to a year's supply of disposable filters— at about one-half the cost.**

BETTER AIR IS OUR BUSINESS



Herman Nelson
Roll-O-Vent
Air Conditioning Unit —*IT CHANGES ITS OWN FILTER—AUTOMATICALLY*

Herman Nelson
Roll-O-Vent
Industrial Unit Heater —*IT CHANGES ITS OWN FILTER—AUTOMATICALLY*

Herman Nelson
Roll-O-Vent
Heating And Ventilating Unit —*IT CHANGES ITS OWN FILTER—AUTOMATICALLY*

AAF
herman nelson

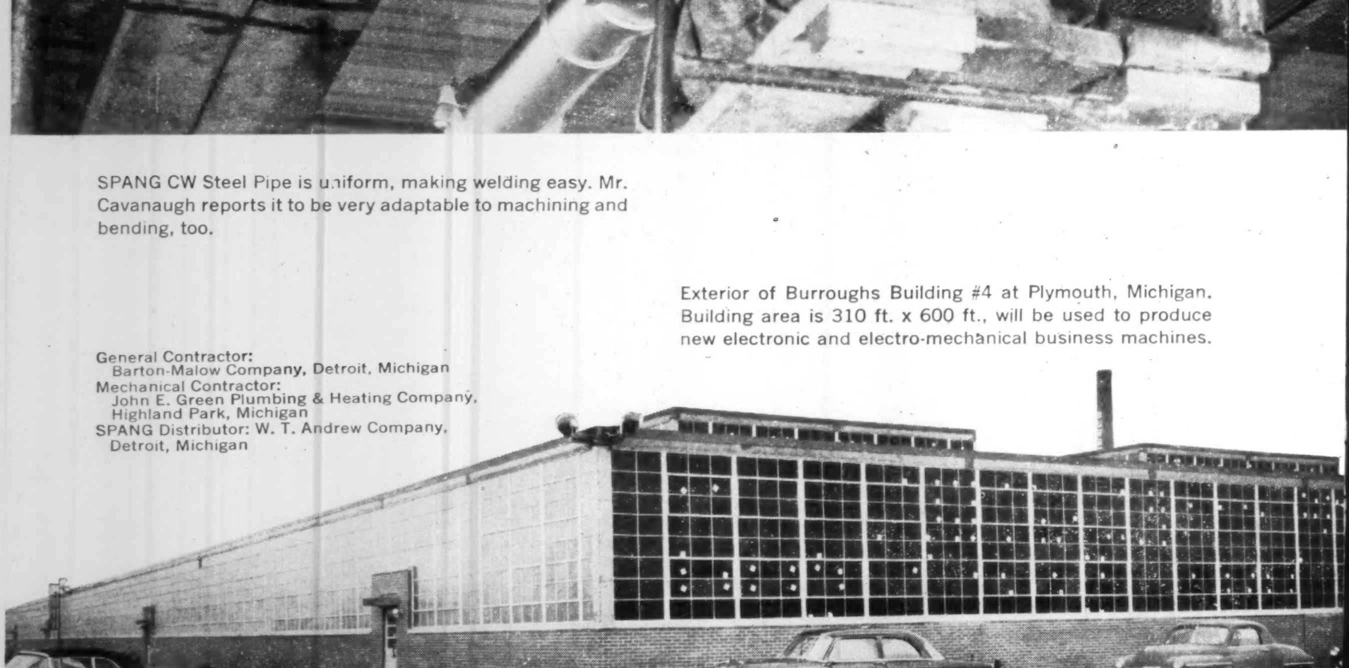
American Air Filter
Company, Inc.
215 Central Avenue • Louisville 8, Kentucky

ANOTHER
SPANG®
CW STEEL PIPE
INSTALLATION

SPANG CW Steel Pipe is uniform, making welding easy. Mr. Cavanaugh reports it to be very adaptable to machining and bending, too.

Exterior of Burroughs Building #4 at Plymouth, Michigan. Building area is 310 ft. x 600 ft., will be used to produce new electronic and electro-mechanical business machines.

General Contractor:
Barton-Malow Company, Detroit, Michigan
Mechanical Contractor:
John E. Green Plumbing & Heating Company, Highland Park, Michigan
SPANG Distributor: W. T. Andrew Company, Detroit, Michigan



"We chose SPANG® Steel Pipe because of its performance record"

...says Mr. William T. Cavanaugh, General Foreman
John E. Green Plumbing & Heating Company, Highland Park, Michigan

"Borroughs Corporation required above-standard, competitive-priced steel service piping at its new Building #4 of the Plymouth, Michigan, Manufacturing and Engineering Division," stated Mr. Cavanaugh. "The intricate production of new electronic and electromechanical equipment dictated it, because any malfunction of the service piping could seriously impede the production effort of the entire plant.

"After examining the performance records of various piping products in similar plants, we concurred on using Spang CW and Lapweld Steel Pipe. It will be used for domestic hot and cold water supply, natural gas, steam and condensate lines, sprinkler systems and compressed air lines.

"This Spang Pipe must be impervious to severe weather conditions, structural stresses and underground faults. From previous experience with Spang, we know that their standards of production guarantee such performance.

"Spang Pipe is also used at four other Burroughs plants in the Detroit area because of its high tensile strength, good interior and exterior finishing and its adaptability to machining and bending. Its corrosive-resistant qualities are above standard, and we have been pleased with the delivery schedules, especially on rush orders."

SPECIFY SPANG AND GET QUALITY

Performance records like this can be yours, too, with Spang Steel Pipe. The quality-controlled manufacturing and careful testing and inspection of the finished pipe before shipping assure you of a top-quality product for every type of piping installation. Your nearby Spang Distributor is ready to serve you. Call him about your next job.

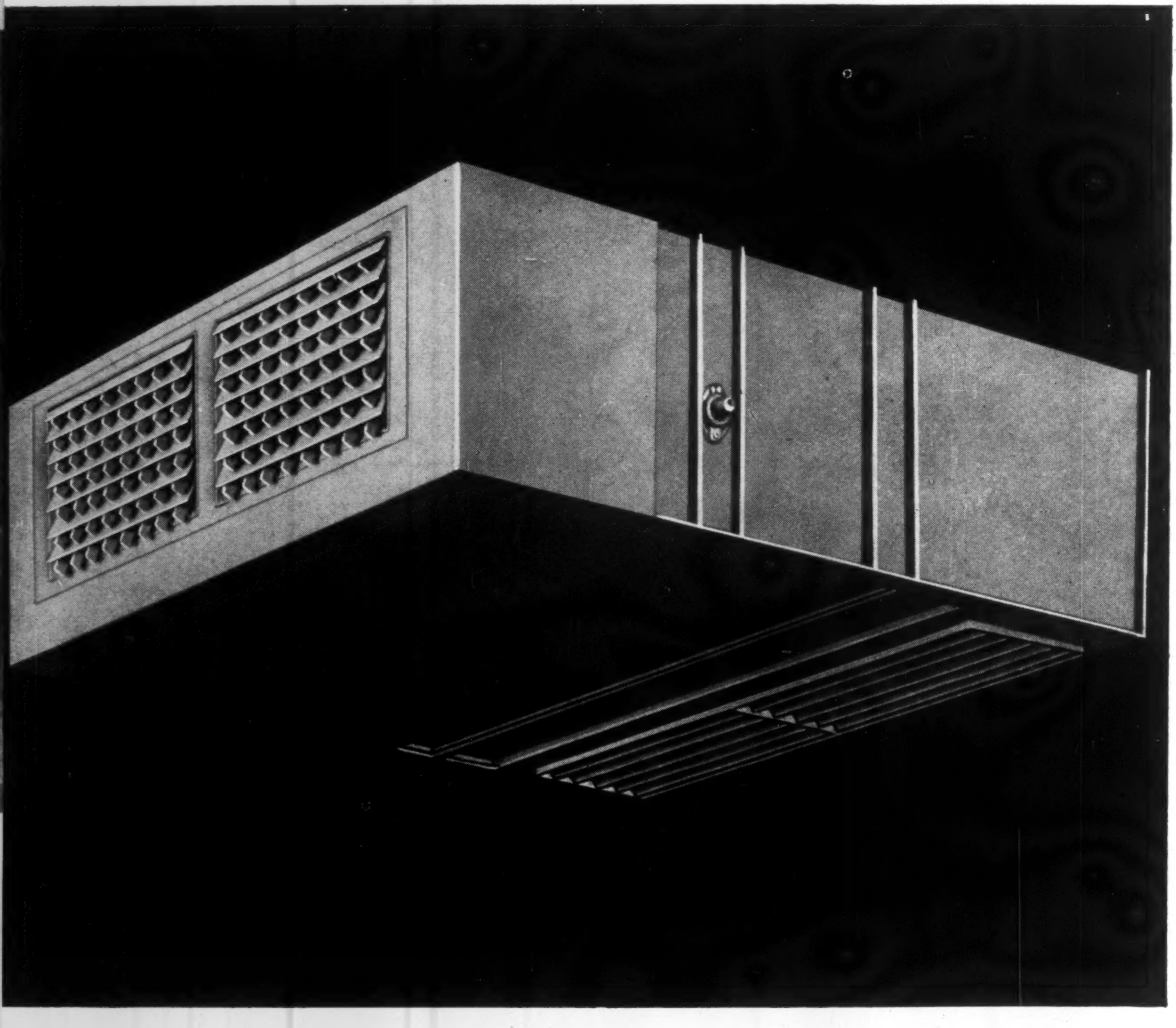
SPANG-CHALFANT
DIVISION OF THE NATIONAL SUPPLY COMPANY
General Sales Offices:
Two Gateway Center, Pittsburgh, Pa.
District Sales Offices: Atlanta, Boston, Detroit, Houston, New York, Philadelphia, Pittsburgh, San Francisco, St. Louis

SPANG® CW STEEL PIPE

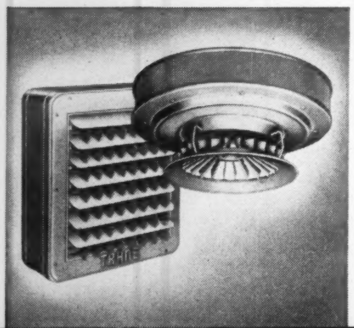
John E. Green Plumbing & Heating Company's General Foreman, William T. Cavanaugh, reports SPANG Pipe was specified after comparing delivery and performance records of other pipe in similar installations.

Painters apply protective finish to piping installation. SPANG CW Steel Pipe serves water, gas, steam, sprinkler and compressed air lines at the Burroughs Plant.

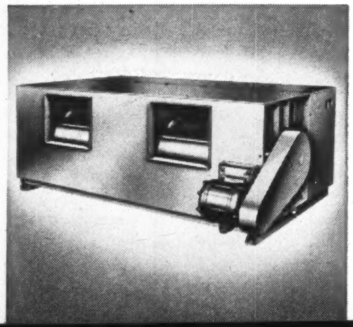
Now! Heating, ventilating with a versatile



FOR SPOT HEATING, TRANE Horizontal and Projection Unit Heaters put the heat where you want it! TRANE exclusive diffusion features give you any selection of heating patterns.



YEAR-AROUND COMFORT! TRANE Climate Changers provide heating or cooling—or both. The multi-zone model provides separate climates for as many as six zones—*at the same time!*



...in any combination Trane Torrivent!

Heat, filter and blend a king-size volume of air for any institutional, commercial or industrial job

The versatile TRANE Torrivent permits you to heat and mix any desired combination of outside and recirculated air to provide just the amount of heating-ventilating you need. Use it with or without ducts; install it on the floor, ceiling or wall—*anywhere* you need a dependable source of warmed, filtered, humidified and tempered air for heating, ventilating or industrial processing.

Next time you're faced with a heating-ventilating job for any kind of building, make it a TRANE Torrivent. There's a complete range of nine sizes to 33,000 cfm. For complete facts on the Torrivent, see your nearby TRANE Sales Office — or write TRANE, La Crosse, Wisconsin.

Check these Torrivent Features:

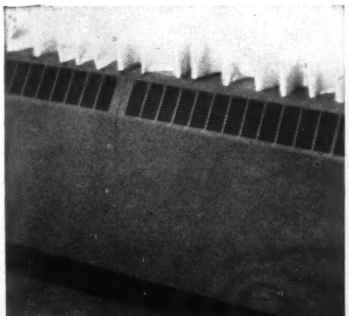
- **QUIET!** New, high-efficiency TRANE Fans have low outlet velocities for smooth, quiet operation.
- **VERSATILE!** Torrivents heat, filter, blend any combination of recirculated and outside air. May be used with or without duct work; install on floor, wall or ceiling. Discharge plenum with exclusive TRANE Diffusers or swivel nozzles permit an infinite number of discharge patterns.
- **FLEXIBLE!** Complete range of coil types and sizes; wide choice of filter box, mixing box, plenum and nozzle combinations.
- **WIDER RANGE!** Nine sizes—1, 2 and 3-fan models —from 1,250 to 33,000 cfm.
- **LONGER LIFE!** Casing is uniframe construction, with heavy gauge phosphatized steel. Fan shafts are solid (not hollow); large diameter for less vibration. Fan bearings are mounted *externally* for easy, simplified maintenance.
- **LOWER COST!** Greater coil and fan efficiency and multiple coil choice permit selection of equipment that meets your heating-ventilating requirements *exactly*. No wasted capacity!

For any air condition, turn to

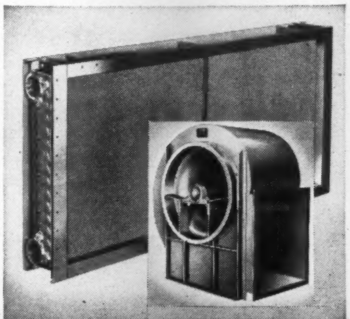
TRANE

MANUFACTURING ENGINEERS OF AIR CONDITIONING,
HEATING, VENTILATING AND HEAT TRANSFER EQUIPMENT

THE TRANE COMPANY, LA CROSSE, WIS. • SCRANTON MFG. DIV., SCRANTON, PA. TRANE COMPANY OF CANADA, LTD., TORONTO • 90 U.S. AND 19 CANADIAN OFFICES



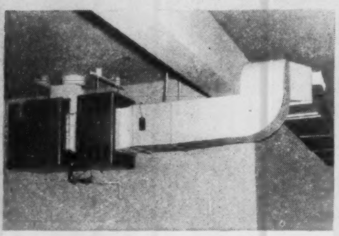
CUSTOM STYLING with production models! New, trim TRANE Wall-Fin is precision built. Closures stay trim and attractive for years due to extra reinforcements at key points.



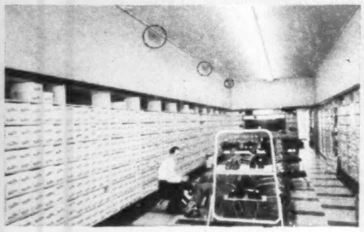
FOR "BUILT-UP" SYSTEMS, TRANE precision-built Fans and Delta Flo Coils step up efficiency of system. Exclusive TRANE Delta Flo Fin provides increased heat transfer efficiency.

WHAT'S BEHIND JANITROL MULTIPLE FOR SHOPPING

CHERRYWOOD SHOPPING CENTER, WANTAGH, L. I., with 25 stores. One of many in the Long Island area designed and built by Berger & Tilles, who have standardized on Janitrol Unit Heaters. Heating Eng. M. Prop; Heating Contractor, Metropolitan Sheet Metal Co., Elmhurst, L.I.

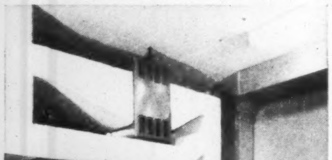


This blower-type Janitrol unit feeding a duct system is typical of the modern heating provided stores at Cherrywood Shopping Center.



Warm air registers (circled in photo) provide efficient heat distribution in the 25 stores at Cherrywood Shopping Center.

CLEVELAND'S FAMOUS VAN AKEN CENTER, built and owned by Zehman-Wolf Construction Company. Weinberg and Teare, Architects. Says Mr. Milton A. Wolf, Partner—"With over 80% of our 27 stores year 'round conditioned, savings in air conditioning equipment were important. To cut costs, but not performance, we specified Janitrol Duct Furnaces in combination with summer cooling units. We are completely satisfied with our Janitrols. We've had no maintenance problems."



Suspended Duct Heater combined with a summer conditioner at Van Aken Center. Bypass duct cuts off air through furnace during cooling season.

Only a Janitrol Multiple Unit System Provides all these Basic Advantages

SAVE UP TO 50% ON INITIAL COST... Compact, factory-assembled Janitrol heaters install easily—save up to 50% on original equipment and installation cost when used in place of a central system.

UNUSUAL ECONOMY OF OPERATION... Actual cost records from major shopping centers show extraordinary savings in fuel and freedom from maintenance expense.

SAVE INCOME-PRODUCING SPACE... Janitrol units are ceiling mounted, save valuable floor space for sales or service needs.

EXTRA-LONG SERVICE LIFE... Janitrol heaters feature the famous Multi-Thermex Heat Exchanger with the finest performance record in

ARCHITECTS AND ENGINEERS' INFORMATION SERVICE . . .

Write today for complete A.I.A. files on heating with gas in big buildings of every type, and for Janitrol planning and specifications service. There's no obligation.

MAKERS OF *Surface* INDUSTRIAL FURNACES, *Kathabar* HUMIDITY CONDITIONING, *Janitrol* COMMERCIAL, INDUSTRIAL AND RESIDENTIAL HEATING AND COOLING EQUIPMENT.

THE TREND TO HEATING UNITS CENTERS?

the industry—less than ¼ of 1% heat exchanger tube failures in over a million tubes since 1940!

SUMMER COOLING EASILY ADDED... Cooling coils are easily added in the same ductwork used for heating. A bypass arrangement cuts off air flow through heater during cooling season.

INDIVIDUAL STORE CONTROL... Tenants control heating to suit individual needs. The building owner is relieved of responsibility for operating costs, maintenance, service.

VERSATILE "DUAL FUEL" PERFORMANCE... Janitrol heaters use any type gas, including LP; may be switched from one type to another automatically.

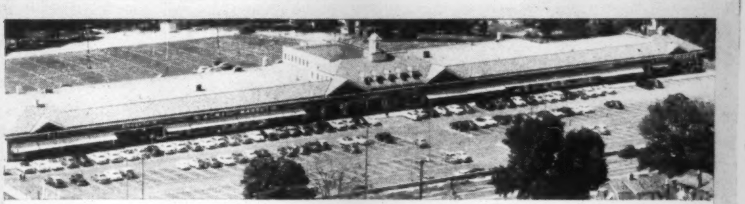
Janitrol field representatives are trained in heating layouts and proper installation methods to assure all the benefits and economies of gas—the clean modern fuel, in an efficient multiple-unit system. They will gladly consult with you on your heating problems.

Janitrol

GAS-FIRED UNIT HEATERS

Janitrol Heating & Air Conditioning Division
Surface Combustion Corporation
Columbus 16, Ohio

In Canada: Moffat Heating and Air Conditioning Division,
Moffats, Ltd., Toronto 15.



68 JANITROL UNIT HEATERS AT EASTGATE SHOPPING CENTER, AKRON, provide clean, economical gas heating with minimum maintenance expense, use absolutely no floor space! The versatility of Janitrol gas-fired heaters makes them easily adaptable for a wide variety of installations. Choice of input capacities from 50,000 to 1,750,000 Btu/hr.

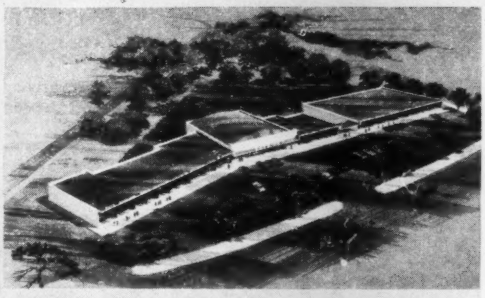
At Eastgate's 13 stores, Janitrol unit heaters
- ... direct heat where most needed
- ... operate only when needed
- ... save valuable floor space

SA-RAY
CLOTHES
SA-RAY

AT LEVITTOWN'S GATEWAY SHOPPING CENTER,

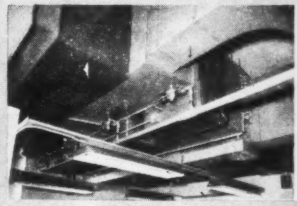
all tenants control their own heating to suit operating hours and individual needs, and the building owner is relieved of responsibility and expense for operation. This convenience for tenants and freedom from furnace financing for the owner is made possible by compact, efficient Janitrol gas-fired unit heaters in place of a central system.

Typical installations of Janitrol gas-fired unit heaters in stores at Levittown's Gateway Shopping Center. Heating-Plumbing Contractors, Latisch and Launer, Brooklyn, N.Y.



NEW DOUGLASTON SHOPPING CENTER, QUEENS, N.Y.

(Architect's sketch.) One of 17 Centers developed by Architect Herbert Tannenbaum, New York City, who says—"I feel it is my responsibility to specify more than just a heating system. I demand proved performance, so I have standardized on Janitrol gas-fired heating. I know, from over a decade of experience, of Janitrol's good record for low maintenance and service costs.



Janitrol Duct Heater installation in Safeway Store at Douglaston Shopping Center.

All
WATERLOO
Registers and Grilles are tested and approved by
ANEMOSTAT®
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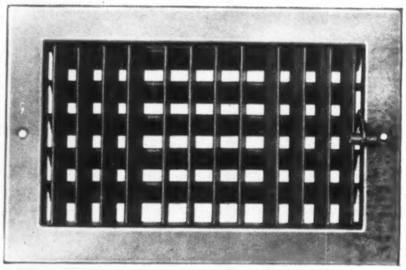
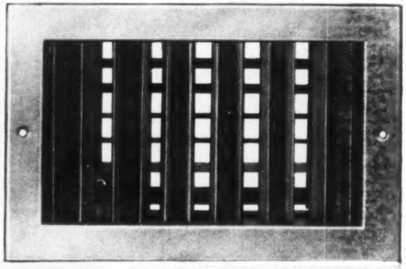
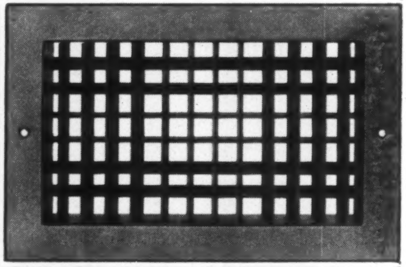
TESTED · APPROVED · ANEMOSTAT CORPORATION OF AMERICA



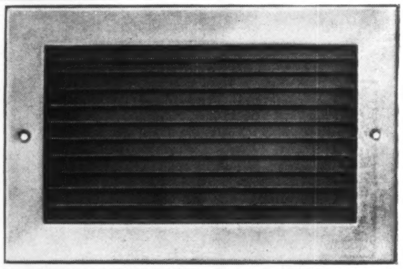
Style 1VMH Supply Register
One set adjustable vertical louvres with multi-shutter damper, horizontal blades.



Style 2VO Supply Register
Two sets of adjustable louvres, front vertical, second horizontal with opposed damper, vertical blades.



Style 2V Supply Grille
Two sets of adjustable louvres, front vertical, rear horizontal.



Style 3H Return Air Grille
One set of horizontal fins fixed down at 45° deflection . . . Also available in 0° deflection.

Waterloo

REGISTERS - GRILLES
VOLUME CONTROL DAMPERS
DOOR VENTILATORS

Write for Waterloo Catalog, containing complete data.

WATERLOO
REGISTER CO., INC.
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WR-101

REGISTERS • GRILLES • VOLUME CONTROL DAMPERS • DOOR VENTILATORS

Wagner Type RA Single-phase Motor
Repulsion-start Induction 1 through 5 hp.

NOW...Wagner's high starting torque Integral hp single-phase motor is available in the latest NEMA frame sizes!

The well-known Wagner Type RA Motor is the workhorse of the single-phase motor field. This repulsion-start, induction-run motor combines the best features of the repulsion motor in starting, with those of the induction motor while running at rated operating speeds—ideal for applications requiring high starting torque.

No other single-phase motor has its ability to continually start heavy loads or perform with such complete satisfaction under continuous service.

Specifically designed for compressors, pumps, machine tools, grinders, and conveyors; it is preferred for many other single-phase high inertia or heavy friction starting applications because of its ability to start such loads with low current and with minimum light flicker.

Let a Wagner field engineer show you how these motors can be applied to your needs. Call the nearest of our branch offices, or write us.

OLD FRAME SIZE	NEW FRAME SIZE
203	182
204	184
224	213
225	215
254	254U

4 pole (1750 RPM, 60 cycle and 1450 RPM, 50 cycle) ratings are interchangeable in mounting dimensions with capacitor-start motors of the same ratings.

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Electric Corporation
SERVING INDUSTRY SINCE 1891

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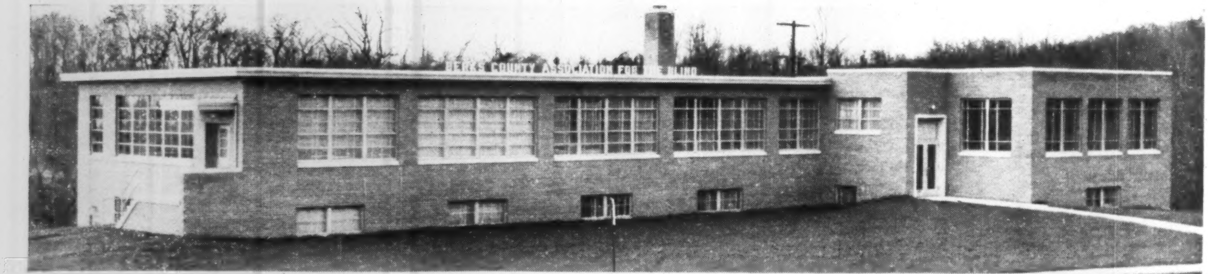
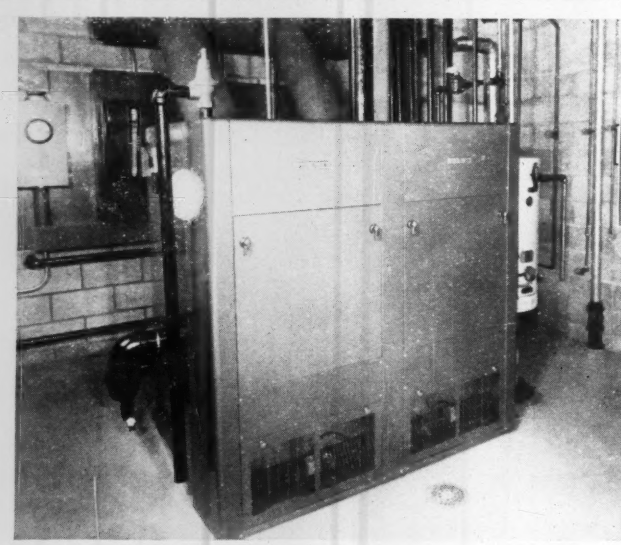
M57-11

ELECTRIC MOTORS • TRANSFORMERS • INDUSTRIAL BRAKES • AUTOMOTIVE BRAKE SYSTEMS—AIR AND HYDRAULIC

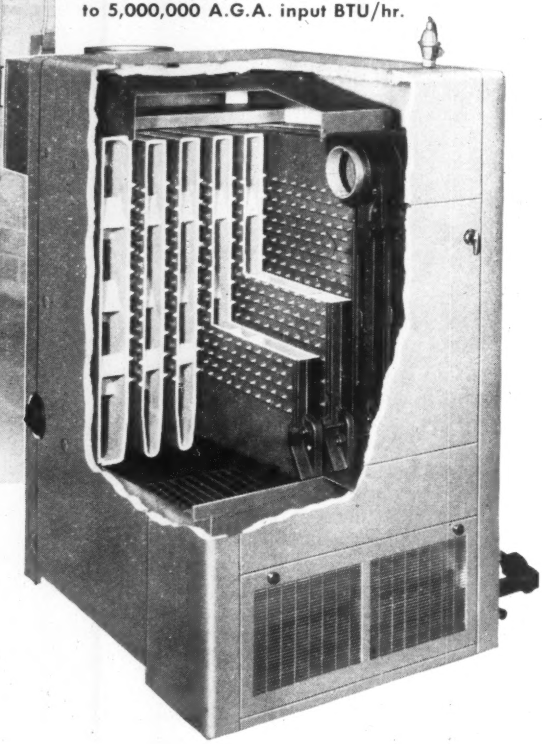
CUT LABOR COSTS...WITH
WEIL-McLAIN TYPE J CAST IRON GAS-FIRED BOILERS



Available in single and multiple units in capacities from 625,000 to 5,000,000 A.G.A. input BTU/hr.



The Reading Association for the Blind, Reading, Pa., relies on a Weil-McLain Type J Gas Boiler for dependable, economical heating



In this school installation, the Weil-McLain Type J Gas Boiler fully lives up to its reputation as an "extra value" unit.

In the matter of labor, for example, the installing contractor, Walter H. Fritz & Company, West Reading, Pennsylvania, writes—

"Although this was the first J Series Boiler we have ever installed, we found that the erection of it went along very smoothly. Two men did the complete job of installing this boiler. We also found that the jacket supplied with this type boiler fit well without any cutting or alterations of any kind. A final test was made after the complete job was installed and we found the boiler was very efficient."

The Type J Boiler is cast iron—for long life and minimum repairs and maintenance. It is compact in design, requiring less floor space and head room. Assembly with short draw-rods simplifies installation—assures a strain-free assembly. Critical examination of its design reveals construction which develops high efficiency in burning fuel and absorbing heat.

This boiler burns all gases, including LP and LP-air and is equipped with controls for completely automatic, safe operation.

WEIL-McLAIN
BOILERS · RADIATORS

WEIL-McLAIN COMPANY
MICHIGAN CITY, INDIANA

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TRADE ® MARKS

In Aluminum too...

Installation of aluminum piping for handling ammonium nitrate.

...a three-way saving in your piping dollars

When you specify TUBE-TURN* products, you are sure of getting the exact fittings for your job because the Tube Turns' line is the world's most complete . . . *you save engineering time.* Your welders can work faster because fittings are completely identified and perfectly uniform . . . *you save construction time.* You can buy all your fittings with one order from your nearby Tube Turns' Distributor . . . *you save purchasing time.* Are *you* getting these savings in piping costs?

*"TUBE-TURN" and "**tt**" Reg. U. S. Pat. Off.

The Leading Manufacturer of Welding Fittings and Flanges

TUBE TURNS

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A DIVISION OF NATIONAL CYLINDER GAS COMPANY

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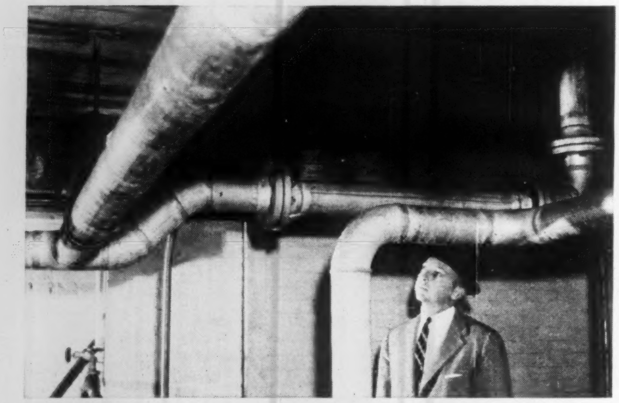
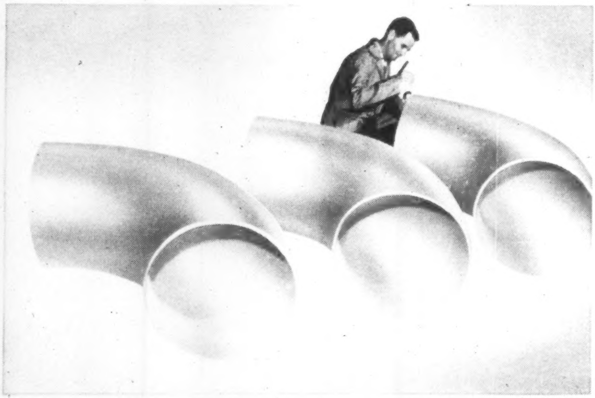
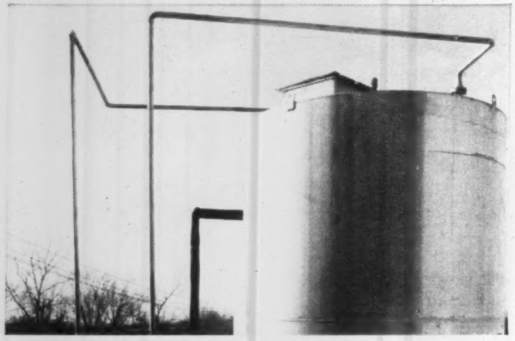
OTHER APPLICATIONS SHOWN ON REVERSE SIDE ▶

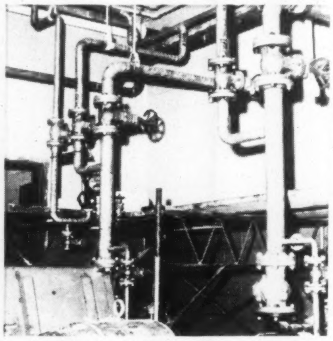
In Aluminum piping too...

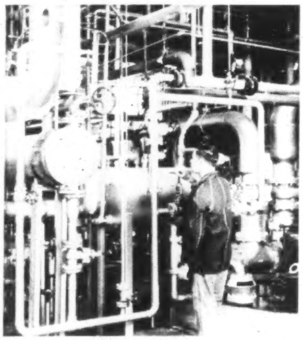
You save manhours with the line of 12,000 TUBE-TURN® products


LIQUID SUGAR. Part of welded aluminum piping system for processing of liquid sugar. When you specify TUBE-TURN* products, you can count on getting the right type, size, schedule and material for every piping service. Saves engineering manhours.


"A-POWER." These TUBE-TURN Aluminum Elbows are for nuclear swimming pool reactor water-coolant lines. Tube Turns' experienced engineering service helps you solve piping problems of all kinds. Contact your nearby Tube Turns' Distributor or District Office.


OLEIC ACID. These welded aluminum lines for oleic acid storage show how this strong but lightweight construction can be utilized for corrosive service. Your nearby Tube Turns' Distributor can give you complete-line service promptly . . . to help you save purchasing time.


REFINERY CATALYST is handled by this aluminum piping, equipped with TUBE-TURN welding fittings and flanges. Uniformity of TUBE-TURN products saves construction manhours


PURE WATER. Passive aluminum piping guards against contamination in this water purification plant. You can buy *all* your fittings with *one* order when you specify TUBE-TURN products.

NEW BOOKLET—This new Tube Turns' catalog gives helpful information on aluminum pipe, fitting and flange materials. Mail the coupon for your free copy.

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Please send free copy of new catalog on Aluminum Fittings and Flanges.

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Company Address ____________

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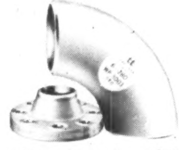

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No. 308
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No. 107
HAMMOND...
The industry's leading line of heating valves

HAMMOND, leader in bronze valves, offers one of the largest and most comprehensive lines of heating valves. Included are packed type radiator valves and elbows for steam and gravity hot water systems, and circulating valves, balancing elbows and fittings for forced hot water heating systems. All are available for copper to copper as well as with screwed ends.

And each of HAMMOND'S 24 different types of heating valves has been specifically designed for outstanding performance in a particular job. For example, No. 107 heavy duty steam angle valve is designed for 150 lbs. WSP. It has a gland follower and double packing . . . plus a backseat which allows it to be repacked under pressure. No. 104 convector gate valve was especially designed for use with convector radiators—has double unions, male and female. No. 201 circulator was developed for use with circulating-type hot water systems—includes male union, and sweat connection. No. 308, for balancing radiant floor, wall and ceiling panels, is a balancing straightaway fitting with sweat connections, no unions.

Write today for a copy of our condensed catalog No. 146 which describes HAMMOND'S complete line of heating valves. HAMMOND heating valves are stocked by a leading plumbing wholesaler in your city. See him today.

HAMMOND BRASS WORKS, HAMMOND, INDIANA

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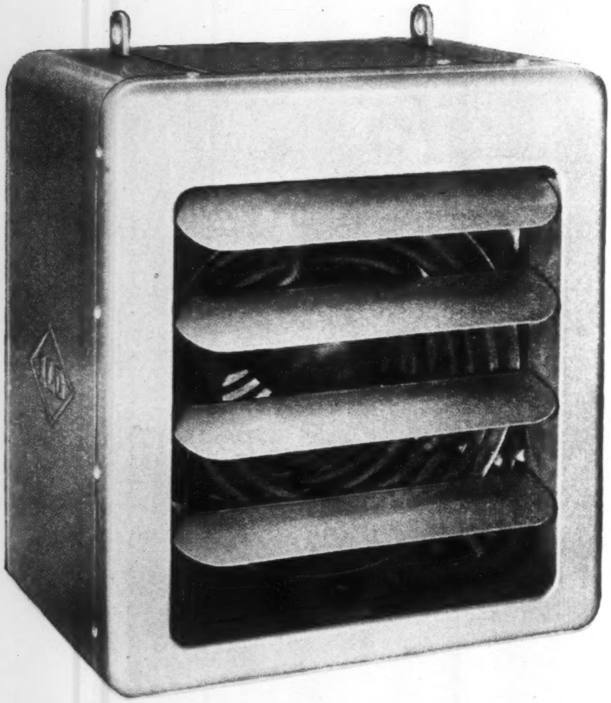
HAMMOND *BRITE-KOTE*® BRONZE VALVES



ILG ELECTRIC UNIT HEATERS bring you electric heat at its best—quiet, fan-circulated, room-wide heat. Quick heat... clean, automatic heat... as dependable as the power that flows through the durable, non-glow type heat element. No exposed wires or terminals in air stream. Heavy duty construction with permanently lubricated motor... built-in overheat protection. Easy to mount from wall or ceiling. Nine sizes, capacities 1½KW to 15KW.

The Man from Ilg can help you choose the right capacity for any application. He is ready to go to work for you. Plan to talk to The Man from Ilg about your next heating or ventilating installation.

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Here is complete information on specifications, sizes, construction features, etc. Write today for your free copy. Request Bulletin 807.

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ELECTRIC UNIT HEATERS

EASY
TO CLEAN
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These valves are available in either non-rising stem, or outside screw and yoke patterns.

Walworth iron body saddle type wedge gate valves are suitable for use on steam, water, gas, gasoline, oil, and many process lines. They are easy to take apart, simple to service, fast to reassemble. Walworth saddle-type valves are available in a wide range of sizes in eleven different combinations of design and materials including bronze-mounted, all-iron, and ni-resist; with both flanged and screwed ends. All types can be repacked under pressure when fully opened or fully closed.

Ask your local Walworth distributor to give you complete information or, write for circular.

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WALWORTH SUBSIDIARIES: ALLOY STEEL PRODUCTS CO. • CONOFLOW CORPORATION • GROVE VALVE AND REGULATOR CO. SOUTHWEST FABRICATING & WELDING CO., INC. • M&H VALVE & FITTINGS CO. • WALWORTH COMPANY OF CANADA, LTD.

Would YOU Contribute to an Economic Slowdown in the United States?

Of Course Not! However, when you buy materials manufactured outside the United States, in preference to quality American-made products, you are doing JUST THAT! Thousands of men who make quality American products would be thrown out of work. They'd stop spending as soon as they'd stop earning! And, as a direct result, the butcher, grocer, clothier, electrical appliance dealer, automobile distributor and builder would do less business. So would the factories that supply them. Slowing down American industry would affect your customers' business and eventually your business.

Note to Contractors:

Continue to BUY AMERICAN quality tubing and pipe—and your dollars will build new American projects . . . new markets for YOU!

READING COPPER-BRASS TUBE
And RED BRASS PIPE

Sold Through Wholesalers Only

READING TUBE CORPORATION

EMPIRE STATE BLDG., NEW YORK 1, N. Y.   PLANT: Reading, Pa.

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9000 Sovereign Row
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57-17 Northern Blvd.

ATLANTA, GA.
690 Murphy Ave.
S.W., Unit 5, Bldg. B

CHICAGO, ILL.
724 W. 50th St.

CLEVELAND, OHIO
4615 Perkins Ave.

OAKLAND, CALIF.
410 Hegenberger Road

LOS ANGELES, CALIF.
120 No. Santa Fe Ave.

DENVER, COLO.
2845 Walnut St.

HOUSTON, TEXAS
1121 Rothwell St.

Economical installation *plus* low fuel bills

New PETRO burners include advanced features that cut heating costs

Equipped with factory designed combustion chamber and air intake register, these modern burners assure maximum combustion efficiency at all firing rates. Air necessary for combustion, unless properly adjusted to any change in oil feed rate, affects efficiency and firing characteristics of any burner. In the new Petro burners, air is precisely controlled with an integral air register. No separate air supply is required.

For oil or combination gas-oil firing

These Petro burners operate with equal combustion efficiency and economy whether firing oil or gas. Existing Petro rotary oil burners can be converted to combination gas-oil firing by the addition of an air register with gas ring and controls.

Can be used with any boiler

The new Petro burners will fit any boiler. A simple adapter ring makes this possible. This reduces installation costs and results in additional savings.

You can bank on Petro dependability and economy

The dependability of the Petro burner is well known. The unit is thoroughly engineered, simple in design, ruggedly constructed and economical in operation. Thousands of Petro owners testify to worry-free heating, with low fuel and maintenance costs.

Send for free literature. For more information and specifications, please mail the coupon.

PETRO

REG. U. S. PAT. OFF.

MAKERS OF QUALITY HEATING AND POWER EQUIPMENT SINCE 1903

PETRO
3531 West 106th Street, Cleveland 11, Ohio
(In Canada: 80 Ward Street, Toronto, Ont.)

Please send me literature and specification sheets on money-saving Petro Gas-Oil Burners.

Name...

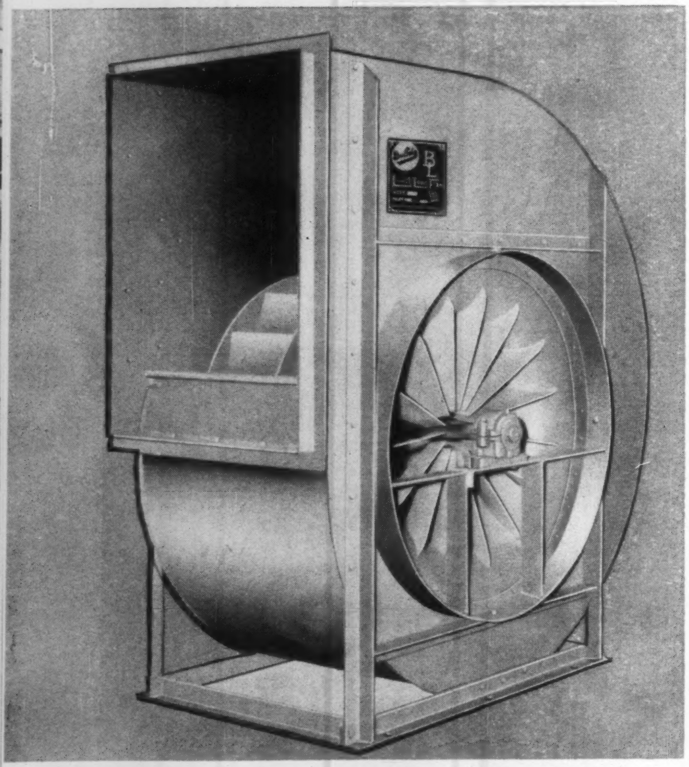
Company...

Address...

City...................................State...................

IF YOU EVER HAVE TO VERIFY

YOU'LL BE GLAD



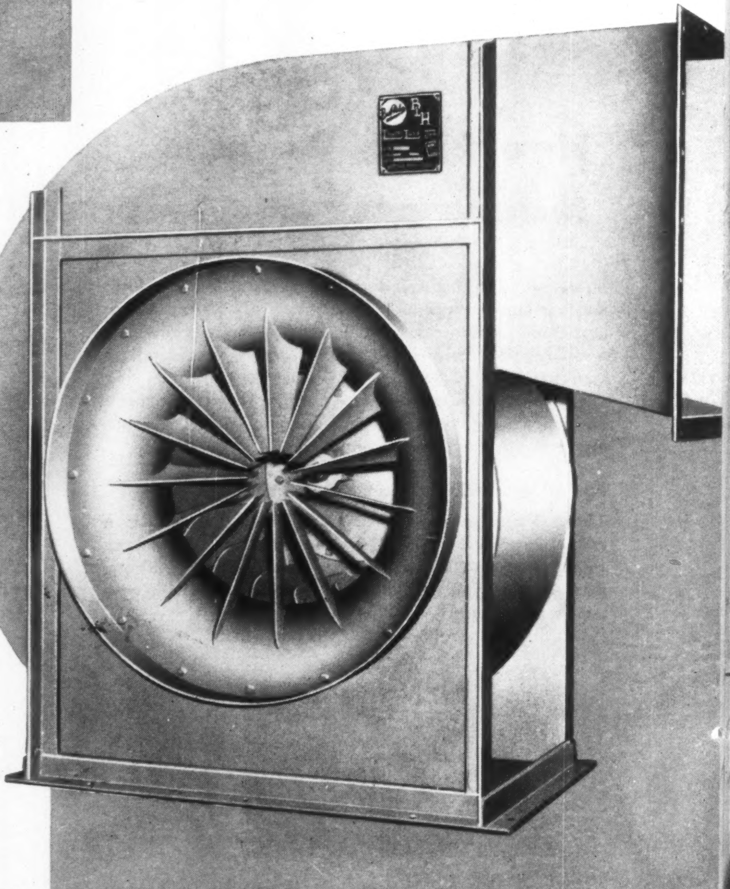
The "Buffalo" Type "BL" Fan, for Class I Service

The "Buffalo" Type "BL" Fan delivers quiet, stable performance over a broad range. This is the result of superior fan design from inlet to outlet.

The fixed inlet vanes insure correct air entry under all conditions . . . the backward curved blade wheel prevents overloading . . . the properly designed cutoff results in smooth conversion.

Installation of the "BL" is simplified by ample flanges at the inlet and outlet, together with a split housing on larger sizes. Available in capacities up to 500,000 cfm.

Bulletin F-102 gives full details on the "Buffalo" Type "BL" Fan.



The "Buffalo" Type "BLH" Fan for Class II-IV Service

Designed for high pressure systems, the "Buffalo" Type "BLH" Fan provides mechanical efficiency in excess of 80% over a broad range of pressure and volume conditions.

Superior design features of the "BLH" include: cantilevered directional inlet vanes for stable air flow . . . smooth inlet bell, deep drawn rotor shroud and backward curved blades for turbulence control . . . the outstandingly efficient divergent outlet, which provides a gradual change from outlet velocity at cutoff to static pressure in the duct.

Complete information on the "Buffalo" Type "BLH" Fan will be found in Bulletin F-200.

VENTILATING AIR CLEANING AIR TEMPERING INDUCED DRAFT EXHAUSTING

PERFORMANCE ON THE JOB

YOU SPECIFIED "BUFFALO"

Maybe you've never been or never will be called-upon to prove the performance of the fans you recommend or install for air conditioning or ventilating jobs. However, as an engineer, contractor or a user of fans, you want to be sure the fans deliver what you've promised.

Here's WHY "Buffalo" Fans Will Positively Deliver Full-Rated Performance On-the-Job:

1. "Buffalo" does *not* merely offer a variation of the same fan to cover all four classes of air moving. "Buffalo" gives you two fans — each specifically designed for highest performance in its own category of air moving jobs: the "BL" for Class I (Moderate Pressure) Service . . . the "BLH" for Class II-IV (High Pressure) Construction.

2. "Buffalo" Fans carry the NAFM Seal of Performance. "Buffalo" Fan Performance Ratings are rigidly based on laboratory tests conducted in accordance with the "Standard Test Code", approved jointly by the American Society of Heating and Ventilating Engineers and the National Association of Fan Manufacturers, Inc.

3. NAFM Ratings for "Buffalo" Fans are verified at the factory. Every "Buffalo" Fan is carefully aligned, balanced and operated before delivery. This is your assurance that the "Buffalo" Fan you specify will live-up to its full rated capacity in on-the-job performance.

Specify the "Buffalo" Fan you're *sure* will do the job it's engineered to do — the "BL", best for Class I Service — or the "BLH", best for Classes II-IV Service. Contact your nearest "Buffalo" Engineering Representative for full information, or write for Bulletin F-102 and F-200.

"Buffalo" Fans feature the famous "Q" Factor — the built-in Quality which provides trouble-free satisfaction and long life.

BUFFALO FORGE COMPANY

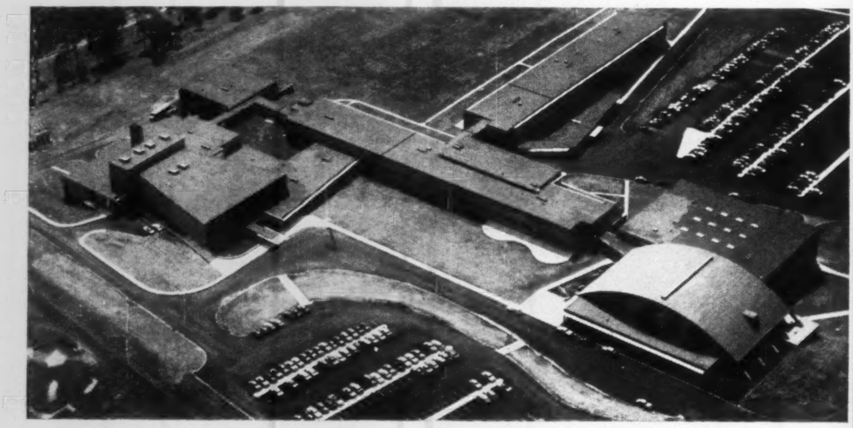
"Buffalo"

BUFFALO, NEW YORK

Canadian Blower & Forge Co., Ltd., Kitchener, Ont.

FORCED DRAFT　COOLING　HEATING　PRESSURE BLOWING

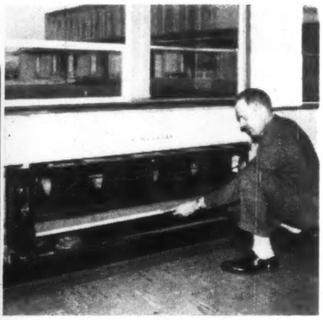
CONTINENTAL
clears the air... in
$6-MILLION HIGH SCHOOL



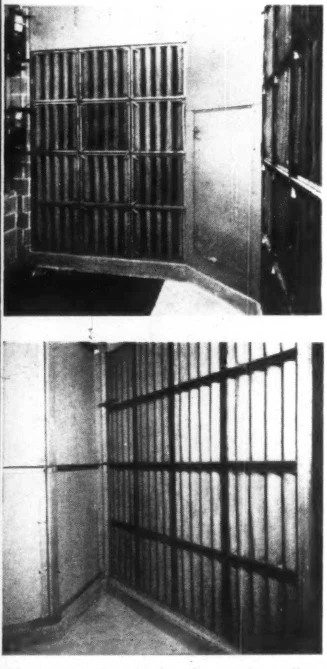
To provide the most healthful and stimulating environment for learning, the progressive school authorities of Abington Township, Pennsylvania, have built this 1500-2000-student senior high school on a 57-acre site. It is an outstanding example of modern institutional design.

To clear the air for the heating and ventilation of the more than 4⅓-million cubic feet within the long, low classroom buildings, the huge auditorium, even larger gymnasium, and the 75′ indoor swimming pool, Continental Air Filters' permanent-type DYCON filters are used throughout.

There is a Continental filter specifically designed to serve almost any air filtration need you may have. If it's a question of clearing the air, ask your nearest Continental representative or write direct to . . .



In each of the 150 classrooms and special service rooms, unit ventilators provide individual thermostatically controlled heat and ventilation. Continental's permanent Type DY DYCON filters clear the air with a minimum of cost and effort. The advantage of this dry-type synthetic media filter:
JUST RINSE and RE-USE!

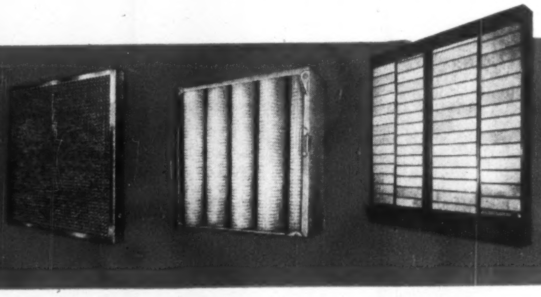


Fan rooms for the heating and ventilating (and future air-conditioning) of the mass-use areas of the school are fitted with Continental's Type CA-24 DYCON extended-surface panel filters. These provide first-rate cleaning performance at surprising low maintenance cost.

AIR CONTINENTAL FILTERS

P. O. BOX 1647 LOUISVILLE 1, KY.

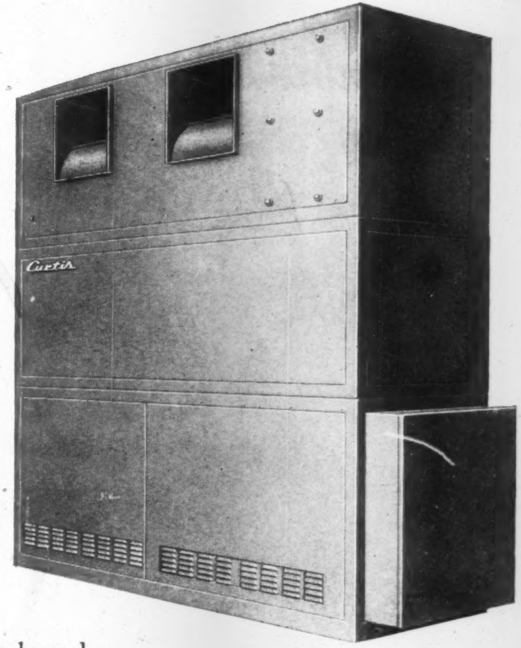
CONTINENTAL
AIR FILTERS Inc.



NOW!

Curtis

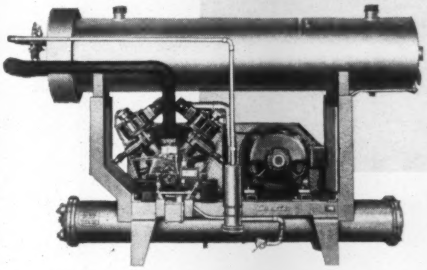
PACKAGED UNITS
Up to 50 Tons
OPENS NEW MARKETS FOR PACKAGED AIR CONDITIONING



No question about it. The new 50-ton Curtis packaged air conditioner will open a new sales front for you. Architects, engineers *and* owners prefer packaged units for important reasons:

- **Big package units are line assembled—does away with expense of field labor. Assures a BALANCED SYSTEM.**
- **Packaged units are easier to install—take up less space.**
- **Cuts down installation problems and maintenance costs.**

IMPROVED PACKAGED LIQUID CHILLER... FOR WET HEAT SYSTEMS



up to 100 tons—

With all controls in single panel box for easier access and greater protection! Four step capacity control—unloaded starting available. Particularly desirable where year 'round conditioning of multiple individual rooms is required.

REMEMBER, every Curtis unit is backed by a solid 103 years of experience and skill. Curtis offers a complete line of air conditioning equipment—nationally advertised to help you sell.

YOU CAN COUNT ON

REMEMBER . . .

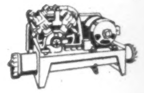
Curtis

OUR 103rd YEAR

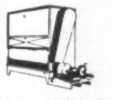
MANUFACTURING COMPANY
REFRIGERATION DIVISION
1950 Kienlen Ave. St. Louis 20, Mo.

CM-16

New Curtis Packaged Air Cooled, Air Conditioning Units, 3 thru 7½ tons. Residential and commercial applications.



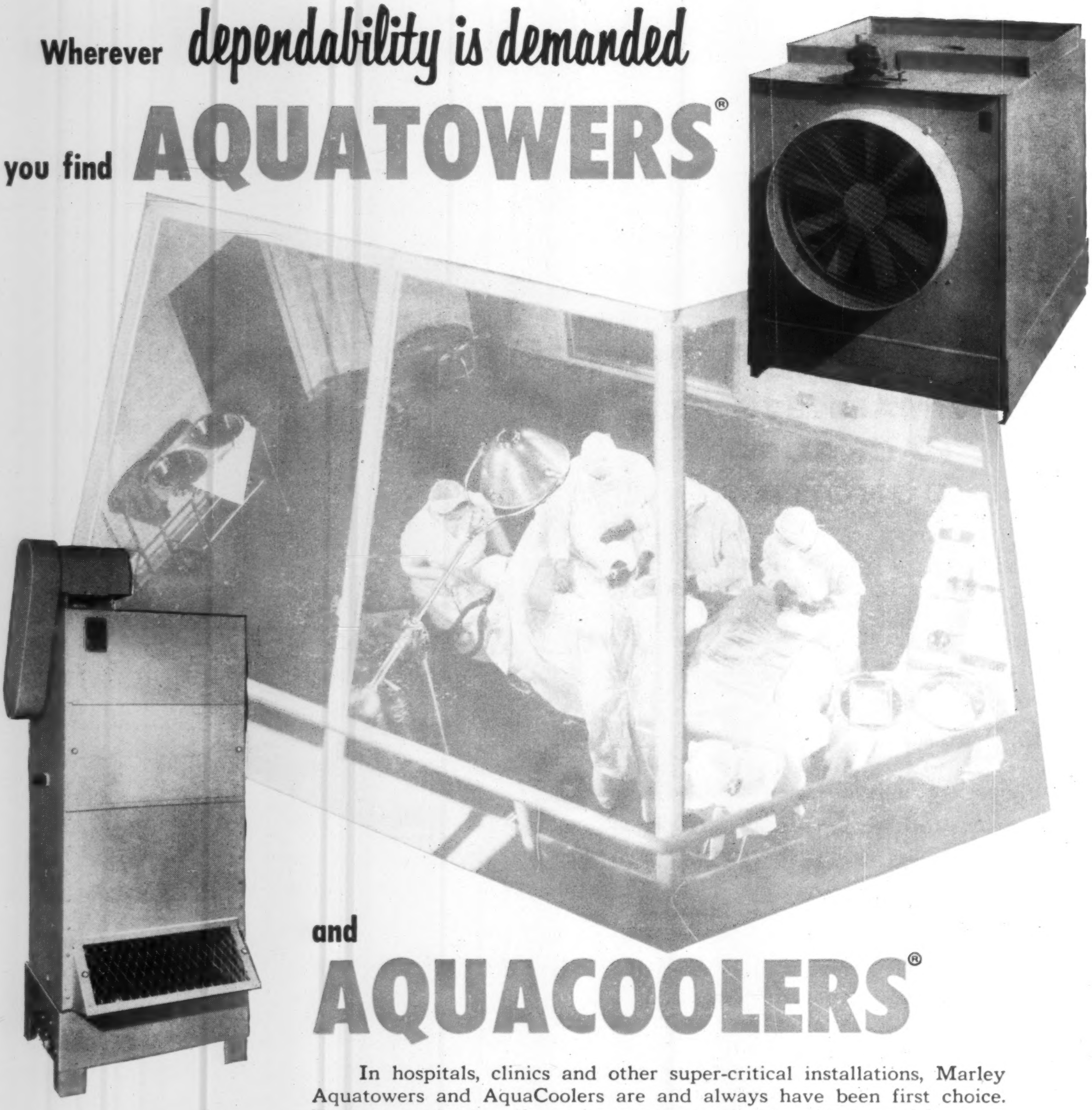
Condensing Units up to 100 tons. F-12 or F-22.



Air Handling Units, Cooling Towers and Evaporative Condensers to match.

Wherever *dependability is demanded*

you find **AQUATOWERS**®



and

AQUACOOLERS®

In hospitals, clinics and other super-critical installations, Marley Aquatowers and AquaCoolers are and always have been first choice. Engineers who specify and contractors who install these jobs have complete confidence in Marley performance because Marley towers have up to 25% more long-life nailless wood filling and exclusive diffusion decks for best water break-up; and they have the engineered aero-dynamic capacity to make the added filling effective.

Marley designs and manufactures mechanical equipment that is specifically engineered for cooling towers—guaranteed to deliver uninterrupted service so vital to these installations, and do it with minimum, non-professonal maintenance.

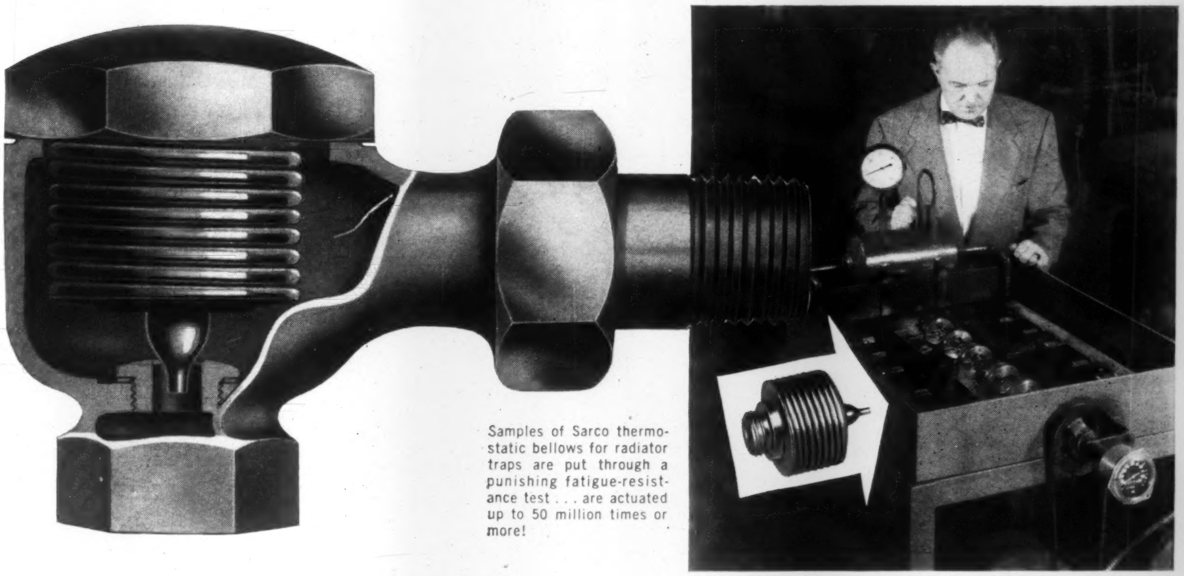
Today every cooling job is "critical"—at least, so far as the contractor's professional reputation is concerned. That's why contractors with an eye to the future standardize on Aquatowers and AquaCoolers for every job, thus fortifying their own good reputation with Marley's record of 35 years' successful cooling tower engineering and production.

MARLEY

The Marley Company Kansas City, Missouri

50,000,000 cycles can't be wrong!

How Sarco guarantees "on-the-job" performance of Thermostatic Radiator Traps



Samples of Sarco thermostatic bellows for radiator traps are put through a punishing fatigue-resistance test . . . are actuated up to 50 million times or more!

This is the most gruelling test a thermostatic radiator trap could possibly get. It's a thermostatic bellows test that goes on endlessly . . . day after day, year after year . . . in the Sarco Research Lab.

In this Sarco research and product development work, thermostatic bellows for Sarco radiator traps are expanded and contracted 50,000,000 times or more to test and study their fatigue-resistance!

Further to assure you the utmost on-the-job dependability, production samples of Sarco thermostatic bellows are tested to *10 million cycles* and more!

OTHER IMPORTANT ADVANTAGES

Extra-strong union nut and nipple — made of bar stock, not just brass castings.

Extra-rugged body — insured by *pressure* casting. Eliminates porosity. Maximum insurance against hidden defects.

Every body pressure-tested at maximum rated steam pressure.

Removable seat — for easy replacement. Seat and self-aligning valve head made of hard bronze.

ASK FOR BULLETIN 150

FOR UNDIVIDED RESPONSIBILITY on your installations, it pays to specify and order from one "Complete Line" source . . . SARCO-SARCOTHERM. Write for catalogs — to Sarco Company, Inc., Empire State Bldg., N. Y. 1, N. Y.

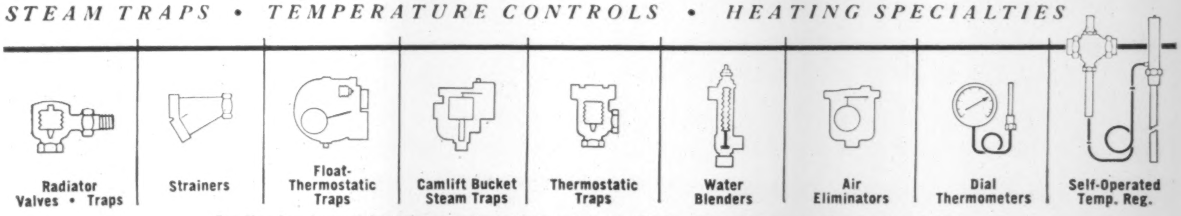
2213-B

SARCO

AN AFFILIATE OF SARCOTHERM CONTROLS, INC.

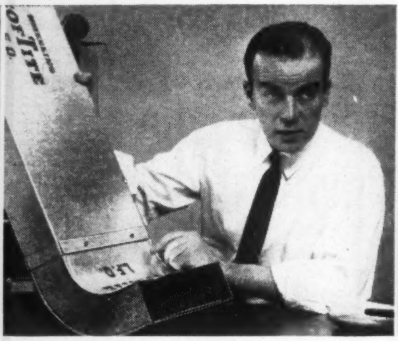
Products you can rest your reputation on

STEAM TRAPS • TEMPERATURE CONTROLS • HEATING SPECIALTIES

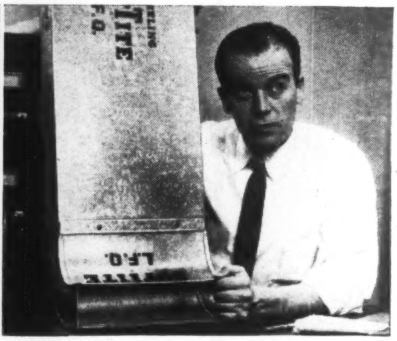


For Heating Control Systems, see Sarcotherm ad, page 67. For Steam Traps, see Sarco ad, page 71

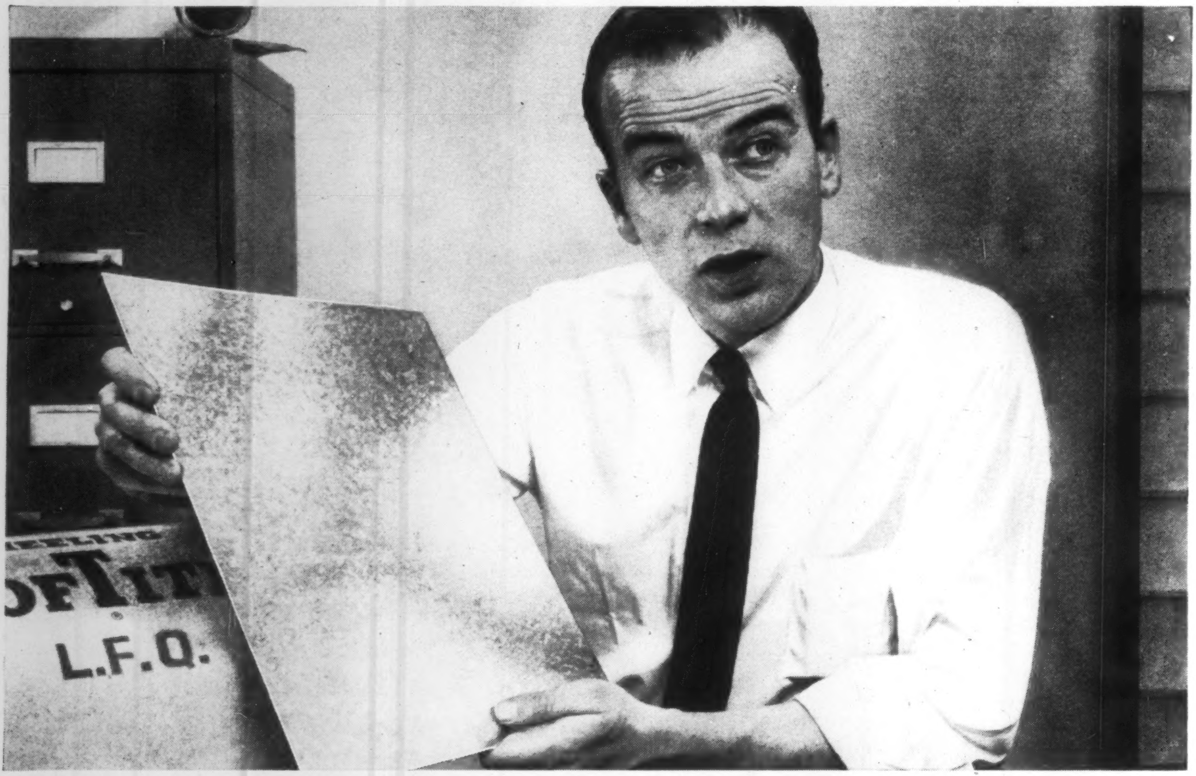
"We can make the most severe operations . . .



and the tightest joints and locks . . .



without fear of the zinc coat cracking because . . .



Wheeling SofTite® has the tightest zinc coating yet produced"

Air conditioning engineers and sheet metal fabricators are discovering untold new economies using Wheeling SofTite Galvanized Sheets.

For one thing, here is a sheet that really *likes* to be worked. It's soft and ductile, easy to form, easy to crimp. But more, SofTite has a tight zinc coating that's almost impossible to chip or flake no matter how severely it is fabricated.

And so Wheeling SofTite lasts far longer. Likewise ducts made of SofTite.

If you are not getting performance like this from your present galvanized sheet, or if you are using ordinary steel sheets for fear that a galvanized sheet can't take the strain, Wheeling SofTite may be your answer.

Call your Wheeling industrial supply distributor, the Wheeling sales office nearest you, or write Wheeling Steel Corporation, Wheeling, West Virginia.

IT'S WHEELING STEEL

DISTRICT SALES OFFICES—Atlanta, Boston, Buffalo, Chicago, Cincinnati, Cleveland, Detroit, Houston, New York, Philadelphia, St. Louis, San Francisco, Wheeling

OUR CHALLENGE STANDS: ANYTHING THAT CAN BE MADE OF STEEL SHEETS CAN BE MADE OF WHEELING SOFTITE GALVANIZED SHEETS

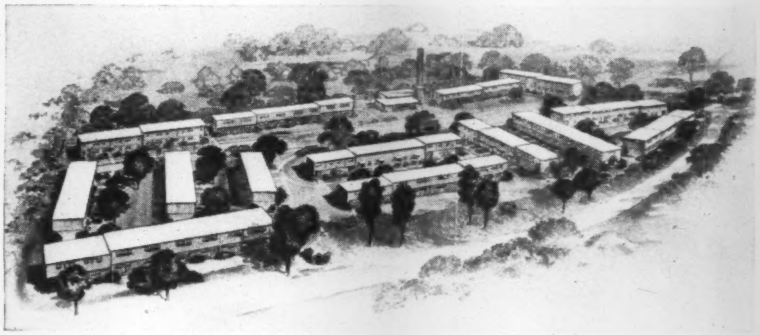
ARCHITECT and ENGINEER

select Sarcotherm heating control system for simplicity – economy – dependability!

Previous favorable experience with the Sarcotherm Weather - Compensated Heating Control System on similar housing projects led to its specification again for the Maywood Terrace Housing Project, Watertown, N. Y., shown, right.

Among the many advantages of this Sarcotherm System are:

(1) Simple, rugged instruments – including unit programming control panel – designed by Sarcotherm specifically for apartment building heating control; (2) quality construction to highest standards; (3) lower installed costs because less wiring required; (4) easily field-adjusted by maintenance personnel to desired temperature levels; (5) fully weather-compensated controls for comfort with fuel economy.



Maywood Terrace Housing Project, Watertown, N.Y.

Equipped with Sarcotherm Weather-Compensated Control Systems for hot water heating. **Built by** – Watertown Housing Authority. **Architect** – Sargent-Webster-Crenshaw & Folley, Watertown, N. Y. **Consulting Mechanical Engineer** – Galson and Galson, Syracuse, N. Y. **Heating Prime Contractors**—Burns Bros., Syracuse, N.Y.

OTHER ADVANTAGES OF SARCOTHERM SYSTEMS

Application engineering — Sarcotherm engineers, backed by years of experience in apartment heating control systems, assist consulting engineers with individualized system diagrams.

Easy to install — tailor-made drawings and diagrams of the complete system are furnished for each job.

Easy to maintain and adjust — by regular maintenance men, because of construction simplicity, fewer parts.

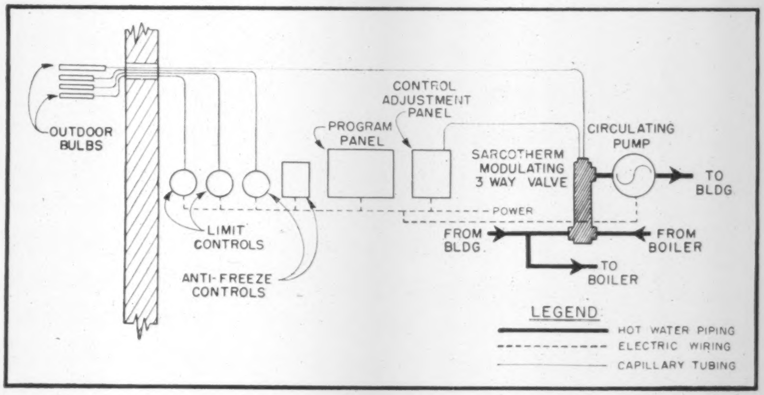
On-the-job assistance — to contractors from Sarcotherm's field engineers.

Undivided responsibility — complete control system plus heating specialties and accessories from one dependable source – Sarcotherm.

★ ★ ★

FOR TECHNICAL BULLETIN NO. 2 on Apartment and Institutional Control Systems write . . . Sarcotherm Controls, Inc., Empire State Bldg., New York 1, N. Y.

4012-B



FEATURES OF THIS SYSTEM

1. Weather-compensated fully-modulated control.
2. Automatic program control for day, night and morning heat-up.
3. Automatic shutdown in mild weather.
4. Anti-freeze protection.

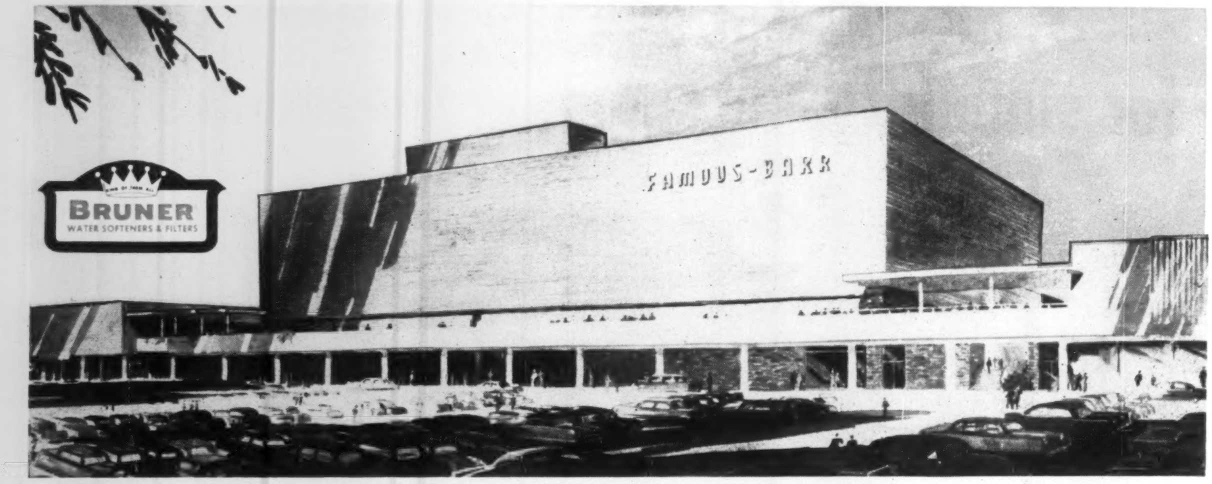
Sarcotherm

AN AFFILIATE OF SARCO CO., INC.

Weather-Compensated control systems for steam, hot water and radiant heating

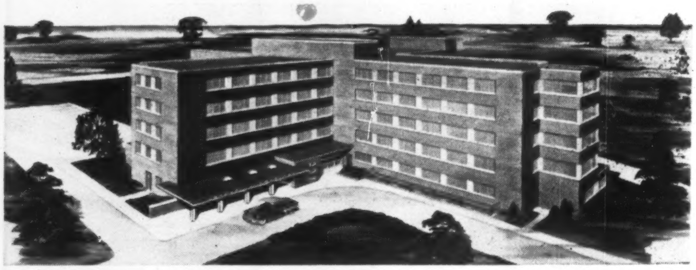
For Radiator Traps, see Sarco ad, page 65 • For Steam Traps, see Sarco ad, page 71

BRUNER INDUSTRIAL WATER SOFTENERS



FAMOUS-BARR BUILDING A in Northland Shopping Center, at Jennings, near St. Louis, Mo.
Consulting Engineers: Ferris & Hamig, St. Louis, Mo.
Architect: Russell, Mullgardt, Schwarz & Van Hoefen, St. Louis, Mo.
Consultants: Marx, Flint & Schonne, Chicago, Ill.
Plumbing Contractor: Thomas J. Sheehan Co., St. Louis, Mo.

ARE FREQUENTLY *Specified* BY LEADING ENGINEERS FOR IMPORTANT INSTALLATIONS!



COMMUNITY HOSPITAL, Indianapolis, Ind.
Engineer: J. M. Rotz Engineering Co., Indianapolis, Ind.
Architect: Daggett, Naegele, Daggett, Inc., Indianapolis, Ind.
Plumbing Jobber: Crane Co., Indianapolis, Ind.
Plumbing Contractor: Freyn Bros., Indianapolis, Ind.

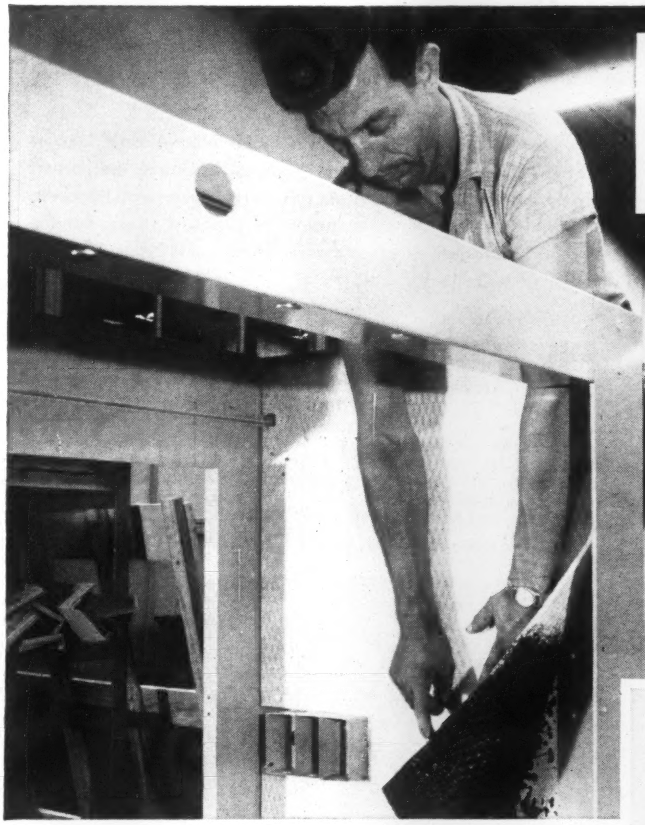
PANTEX ORDNANCE PLANT, St. Francis, Tex.
Engineer & Contractor: Silas Mason Co., Amarillo, Tex.

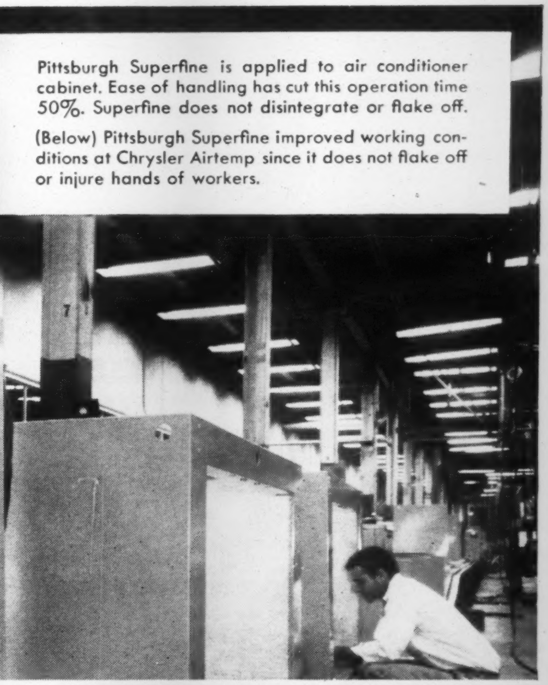
Bruner Industrial Water Softeners are meeting the needs of these important installations and in many other public and private buildings in all 48 states and seven foreign countries. They range from small laundries, schools, motels and resorts to huge hospitals, hotels, factories and atomic energy plants. Bruner is proud of its customer service — famous for product performance.

Bruner softeners, filters and other water conditioning components are available from stock in many types and sizes. Custom installations are fabricated to exact specifications.

Automatic Industrial Type Water Softener

BRUNER CORPORATION
America's most complete line of quality water softeners and filters
Executive Offices: 4763 N. 32nd St., Milwaukee 9, Wis.
Telephone: HIllop 2-3200
Plants: Milwaukee, Wisconsin, and Los Angeles, California
Sales and Engineering Offices in all principal cities.





Pittsburgh Superfine is applied to air conditioner cabinet. Ease of handling has cut this operation time 50%. Superfine does not disintegrate or flake off.

(Below) Pittsburgh Superfine improved working conditions at Chrysler Airtemp since it does not flake off or injure hands of workers.

Pittsburgh Superfine cuts installation time 50%, helps produce better end products at Chrysler Airtemp

Production requirements at the Airtemp Division of Chrysler Corporation, Dayton, Ohio call for a flexible, well-bonded, efficient glass fiber insulation for air conditioning and heating units to prevent condensation or heat transfer at metal cabinet walls. Pittsburgh Superfine fulfills these requirements.

Glass fiber insulation previously used flaked off, would be ejected by the air stream. Measures improvised to correct this were costly and added production time.

But PPG Superfine, being specially bonded, avoided this disintegration. Superfine prevents condensation on cabinet walls and eliminates excessive temperature rise in heating unit enclosures.

Easier handling, too!

The rigid, brittle glass fibers of the material previously used caused dangerous cuts on workers' hands, despite heavy gloves. The old material was hard to position during assembly.

Now with Pittsburgh Superfine, installation time is cut in half. Superfine is flexible, easy to handle, does not flake off or cause cuts. Working conditions are much improved.

What can Pittsburgh Superfine do for you?

Pittsburgh Superfine offers you top insulating results in heat or cold applications . . . and in sound deadening, too! Find out about all its advantages. Then give it a try. For more information, write *Pittsburgh Plate Glass Company, Fiber Glass Division, One Gateway Center, Pittsburgh 22, Penna.*

PITTSBURGH SUPERFINE IS A PRODUCT OF THE FIBER GLASS DIVISION OF PITTSBURGH PLATE GLASS COMPANY

Sales Offices are located in the following cities: Charlotte, Chicago, Cincinnati, Cleveland, Detroit, Houston, Los Angeles, New York, Philadelphia, Pittsburgh and St. Louis

FIBER PPG GLASS

PAINTS • GLASS • CHEMICALS • BRUSHES • PLASTICS

PITTSBURGH PLATE GLASS COMPANY

Always Stronger Than They Need Be!

MIDWEST
WELDING FITTINGS

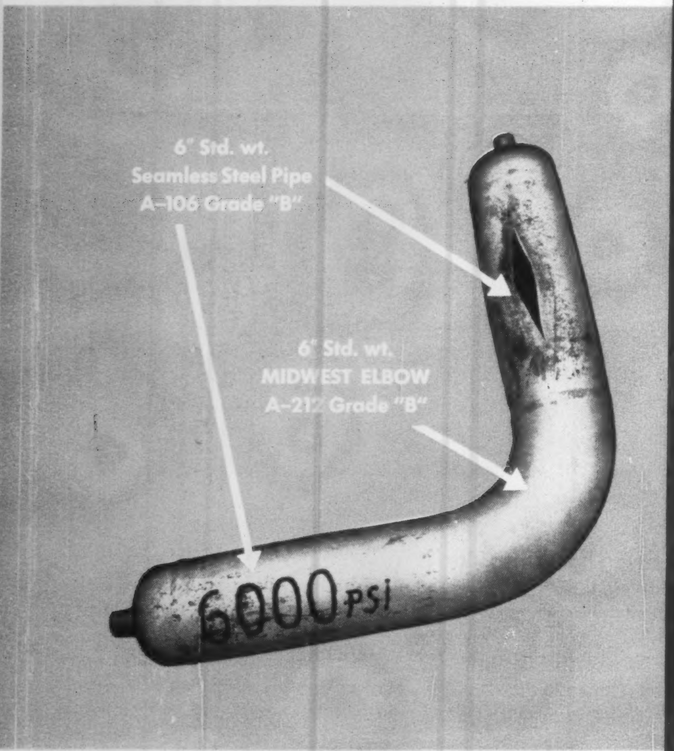
Below are photographs of two of the many tests that have been made of Midwest Welding Fittings. The results are *always* the same . . . the seamless pipe to which the fittings are welded invariably bursts. There is *never* any sign of fitting failure or weakness.

There's good reason for this. We make elbows and tees of inherently stronger metal . . . the Midwest exclusive method of manufacture enables us to maintain greater minimum wall thickness, and to reinforce the fittings at points of greatest stress. For the many other advantages of Midwest Fittings, ask your Midwest distributor or write us for Catalog 54.

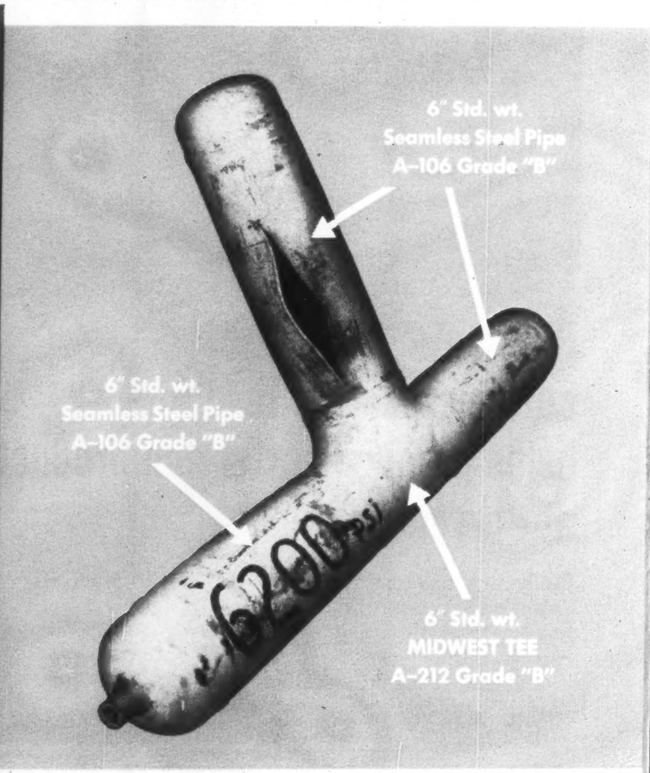
MIDWEST PIPING COMPANY, INC.
Main Office: 1450 South Second St., St. Louis 4, Mo.
PLANTS: ST. LOUIS, CLIFTON, N. J. and LOS ANGELES

SALES OFFICES:
ASHEVILLE (BOX 446, SKYLAND, N. C.) • BOSTON 27—426 FIRST ST.
CHICAGO 3—79 WEST MONROE ST. • CLEVELAND 14—616 ST. CLAIR AVE.
HOUSTON 2—1213 CAPITOL AVE. • LOS ANGELES 33—520 ANDERSON ST.
MIAMI 34—2103 LE JEUNE RD. • NEW YORK 7—50 CHURCH ST.
ONEIDA, N.Y.—282 NORTH MAIN ST. • SAN FRANCISCO 11—420 MARKET ST.

STOCKING DISTRIBUTORS IN PRINCIPAL CITIES



Typical bursting test of stock Midwest Welding Elbow. As is always the case, failure occurred in the seamless pipe while the elbow was undamaged. Bursting pressure was 6000 psi . . . considerably above the required code minimum for seamless pipe. (Minimum allowable bursting pressure for 6" standard weight A-106 Grade B seamless steel pipe is 4438 psi.)



Bursting test of Midwest Welding Tee taken at random from stock. As always, the failure occurred in the seamless pipe and not in the fitting. The non-shock internal bursting pressure of 6200 psi is well above the code minimum for seamless pipe. (Minimum allowable bursting pressure for 6" standard weight A-106 Grade B seamless steel pipe is 4438 psi.)

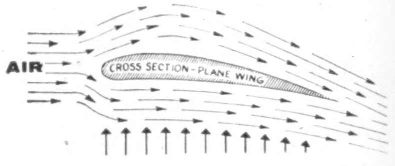
7761

MIDWEST **WELDING FITTINGS IMPROVE PIPING DESIGN AND REDUCE COSTS**

HOW THIS MODERN STEAM TRAP UTILIZES PRINCIPLE OF AIRPLANE LIFT!

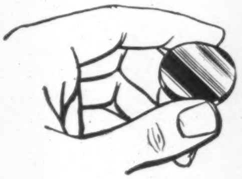
New application of an old principle produces totally different type of steam trap . . . of great simplicity and effectiveness

THIS GIVES AN AIRPLANE LIFT

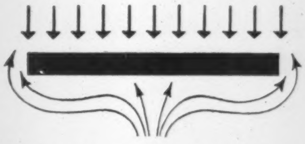


Greater speed of air over curved upper wing surface creates lower pressure over this area (Bernoulli's Law) . . . resulting in **lifting** force.

THIS SAME PRINCIPLE USED TO CLOSE SARCO TD STEAM TRAP VALVE



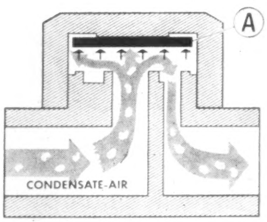
Valve is a simple hardened stainless steel disc.



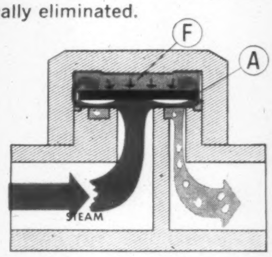
High velocity steam jet across bottom of valve disc creates low pressure area — resulting in **downward** force.

ONLY SARCO TD USES THIS UNIQUE OPERATING PRINCIPLE

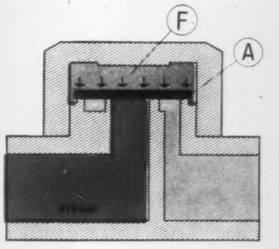
Result: Extreme simplicity—no valve mechanism—maintenance practically eliminated.



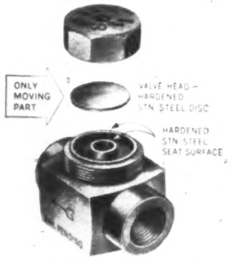
1. Inlet pressure raises disc "A" from seat . . . immediate discharge of air and condensate at steam temperature.



2. Steam follows condensate and the high velocity jet across bottom of disc "A" creates low pressure area (Bernoulli effect) . . . jet is deflected into chamber "F" where it builds up pressure by recompression and this pressure acts on top of disc "A" . . .



3. Pressure in chamber "F", acting on full top area of disc "A", exceeds force of incoming steam and low pressure area under disc . . . and immediately forces it down, closing inlet. As condensation decreases pressure in chamber "F", disc rises and steps 1 or 2 repeat.


ONLY MOVING PART
VALVE HEAD—HARDENED STN STEEL DISC
HARDENED STN STEEL SEAT SURFACE

Small size . . . large capacity

Only 3 parts . . . all stainless steel. Sizes 3/8 to 1"—each body is as small as a tee fitting! Capacity is determined not by a bulky body but by the effective orifice, valve action, pressure drop and condensate temperature.

A few of many advantages

* *Practically no maintenance*—no valve mechanism, no narrow channels. Trouble-free, simple design.

* *Cuts trap inventory*—one large capacity seat for all pressures . . . for heavy, light, or no condensate load.

* *Self-adjusting for pressures 10 to 600 psi*—not a single change or adjustment required.

* *Operates perfectly when pressure fluctuates*—throughout full pressure range.

SEE FOR YOURSELF

We will gladly send you a Sarco TD Steam Trap and strainer for 60-day trial. No cost or obligation. Advise size —3/8, 1/2, 3/4 or 1"—and application. Sarco Company, Inc., Empire State Bldg., New York City.

2204-C

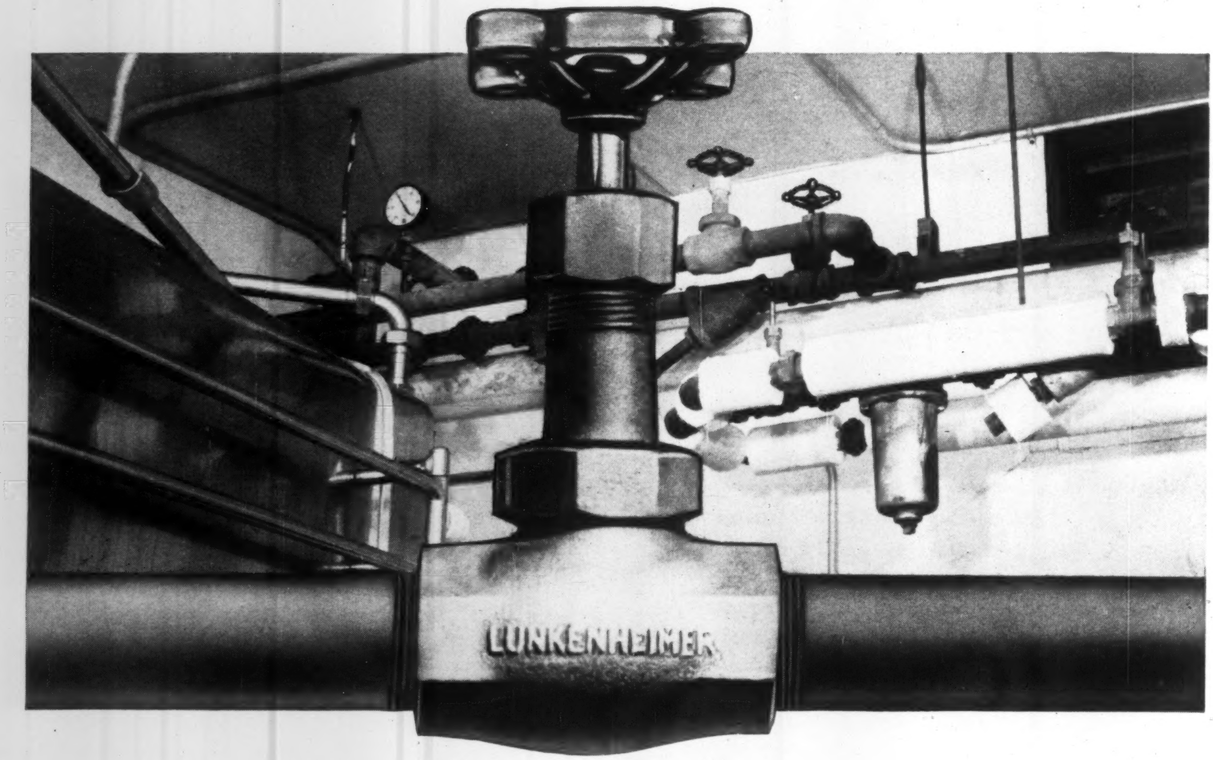
SARCO Thermo-Dynamic STEAM TRAP

TRADE MARK

THE MODERN TRAP THAT IS MAKING STEAM TRAPPING HISTORY!

For Radiator Traps, see Sarco ad, page 65 • For Heating Control Systems, see Sarcotherm ad, page 67

ONE ANSWER
to spiraling maintenance costs



LQ600—The Most Maintenance-Free Bronze Globe Valve Ever Developed!

The moment a maintenance man touches a wrench to a valve, its cost can double. You can't bring down that labor expense in many plants, but you can buy valves with an outstanding record of trouble-free service. At no time in history has valve quality been so important to your total plant expense. And quality has been a tradition for nearly a hundred years at The Lunkenheimer Company, Box 360, Annex Station, Cincinnati 14, Ohio.

See your cost-reducing Lunkenheimer distributor . . . or write for literature.

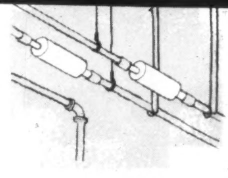
BRONZE • IRON • STEEL • PVC

The cost of a LUNKENHEIMER VALVE
Gets smaller... and smaller... and smaller...
with each passing year of dependable service

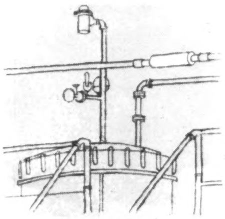
L-757-9

LUNKENHEIMER
QUALITY ®

LUNKENHEIMER®
THE ONE *Great* NAME IN VALVES

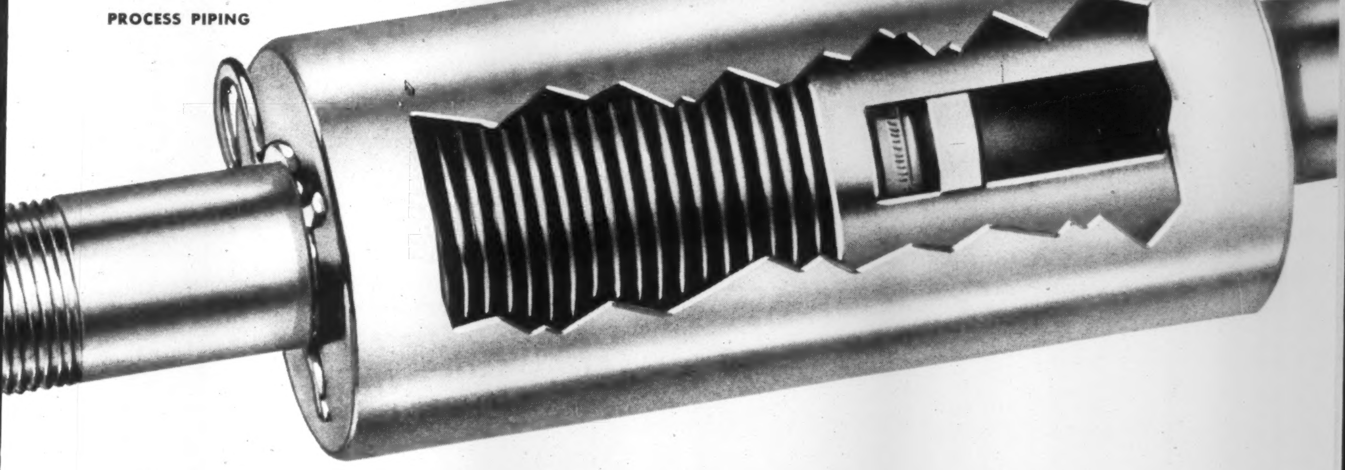


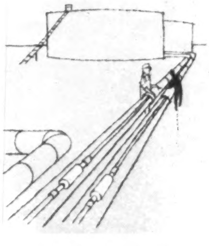
HEATING SYSTEMS



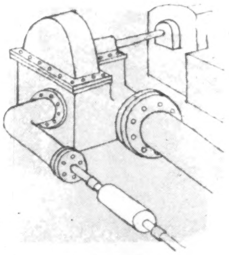
PROCESS PIPING

NOW . . . high-pressure, heavy-duty Expansion Compensator costs far less than old-fashioned methods... *available from stock!*





STEAM TRACING



POWER PIPING

Flexon®

MODEL H EXPANSION COMPENSATOR

Get delivery when you want it! Flexon Model H Expansion Compensators are available from stock. And they cost much less per inch of stroke than any other method of absorbing pipe expansion.

Flexon Model H is made to fit the thousands of industrial piping jobs that use pipe up to 3″ and require less than 1¾″ total movement. It's built for hard service, with 2-ply stainless steel Flexon Bellows, positive anti-torque and anti-squirm device, and full protection from external damage. Completely packless, it never needs maintenance. Working pressures up to 150 p.s.i. for ¾″ and 1″ sizes; up to 100 p.s.i. for larger sizes.

Write for facts about Flexon Expansion Compensator, design and cost data, and the name of your Flexon distributor.

Flexonics corporation

EXPANSION JOINT DIVISION • 1391 S. THIRD AVENUE, MAYWOOD, ILLINOIS

EXPANSION JOINTS   METAL HOSE   NON-METALLIC HOSE   BELLOWS   AIRCRAFT COMPONENTS

FORD ASSEMBLY PLANT. Hundreds of tons of Bethlehem Pipe were used in constructing this Ford Motor Co. plant, Mahwah, N. J. Plumbing and Heating Contractor: August Arace & Sons, Inc., Elizabeth, N. J. Jobber: A. and J. Friedman Supply Co., Inc., Passaic, N. J.

Assembly Plant in New Jersey— Apartment Building in Baltimore

Both Have Beth-Co-Weld Piping

Whether you plan to install general-purpose pipe in industrial buildings, apartment structures, or some other type of construction, you can be sure of a dependable job with Beth-Co-Weld steel pipe.

Beth-Co-Weld is ideal for general-purpose piping because of its strength and uniformity, and because it is so easy to cut, thread and weld.

Beth-Co-Weld is made by the continuous-weld process, and comes in diameters from $\frac{1}{2}$ in. to 4 in., standard weight and extra strong. Both weights are furnished in 21-ft lengths, plus or minus 1 in., as well as in random lengths. Keep asking for Beth-Co-Weld.

FLAG HOUSE COURTS. This 12-story structure, like its neighbors in a slum clearance project in Baltimore, Md., has Beth-Co-Weld piping throughout. Plumbing and Heating Contractor: Continental Engineers Inc., Decatur, Ga. Pipe Jobber: J. T. Roberts & Bro., Inc., Baltimore. ▶

BETHLEHEM STEEL COMPANY, BETHLEHEM, PA.

On the Pacific Coast Bethlehem products are sold by Bethlehem Pacific Coast Steel Corporation
Export Distributor: Bethlehem Steel Export Corporation

BETHLEHEM STEEL

BETHLEHEM STEEL

SKIL portable tools SAVE 50% production costs at Guerin-Zimmerman Co.

Paul Guerin, owner of this metal fabricating company, purchased SKIL Drivers and SKIL Disc Sanders for the assembly of sheet metal parts in his Cleveland shop. The immediate result of this change—production increased 50% at the same costs.

All the metal fabrication requires intensive sanding with disc sanders. The SKIL tools stay on the job longer under continuous use and are much easier to handle, report the men in the shop. Plus little downtime for maintenance. It means a 50% saving in production costs.

The experience of this company adds up to big savings—savings in time, money and labor. You, too, can SAVE with SKIL tools. Ask a SKIL distributor to show you the features of SKIL metalworking tools that can mean savings on your jobs. Or for a FREE catalogue on power tools write SKIL Corp. direct: Dept. HFT-97, 5033 Elston Avenue, Chicago 30, Illinois.

SKIL

Made only by SKIL Corporation, manufacturer of famous SKIL and SKILSAW products, 5033 Elston Avenue, Chicago 30, Ill. In Canada: 3601 Dundas St. West, Toronto 9, Ont.

On metalworking operations, you SAVE with SKIL tools

ACCO
for Better
Values

R-P&C Valves

DESIGNED FOR DEPENDABILITY

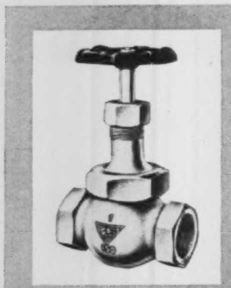


Fig. 1-A, rated for 150 lbs., has special asbestos composition disc for tight shutoff

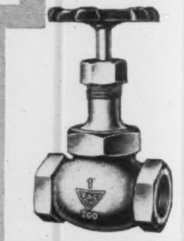


Fig. 409, rated for 200 lbs., has integral high test bronze seat for easy regrinding

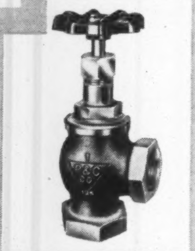


Fig 033 Angle Valve, rated for 125 lbs., has integral seat, re-grinding type disc

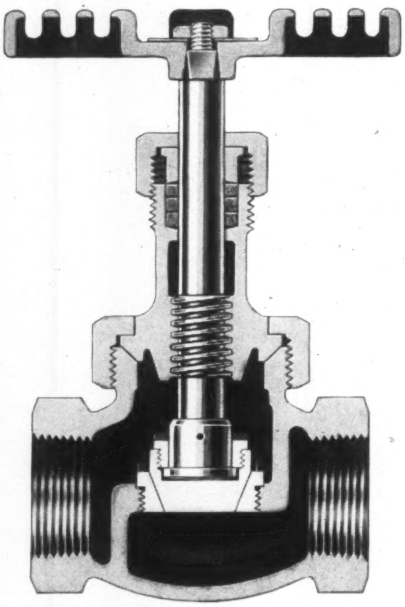


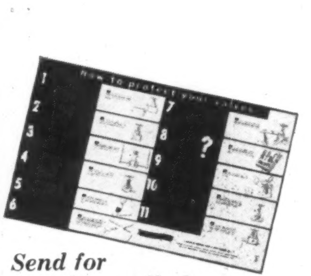
Fig. 427-DP Bronze Globe Valve

R-P&C Distributors offer 9 different models of Bronze Globe Valves—What are your requirements?

• You can select the R-P&C globe or angle valve to meet your particular requirements from a wide variety of seat and disc constructions, with union or screwed bonnet, screwed ends, in pressure classes from 125 to 300 pounds. Your R-P&C distributor offers 9 different bronze globe valves, each in a complete range of sizes—and 8 different models of angle valves which duplicate the construction features found in the globe valve line.

For example, if your application calls for frequent or continuous throttling in steam, water, oil or gas service, the **Fig. 427-DP** shown above is probably your best bet. The full plug construction gives you closer regulation. And the 500 Brinell stainless steel seat and disc resist wire drawing—give you much longer valve life.

Your R-P&C distributor can recommend the specific valve to answer your particular problem. And he has an equally wide selection in R-P&C's complete line of angle, gate and check valves in iron and cast steel, as well as forged steel gate valves. See him today.



Send for this free wall chart
"How to Protect Your Valves"

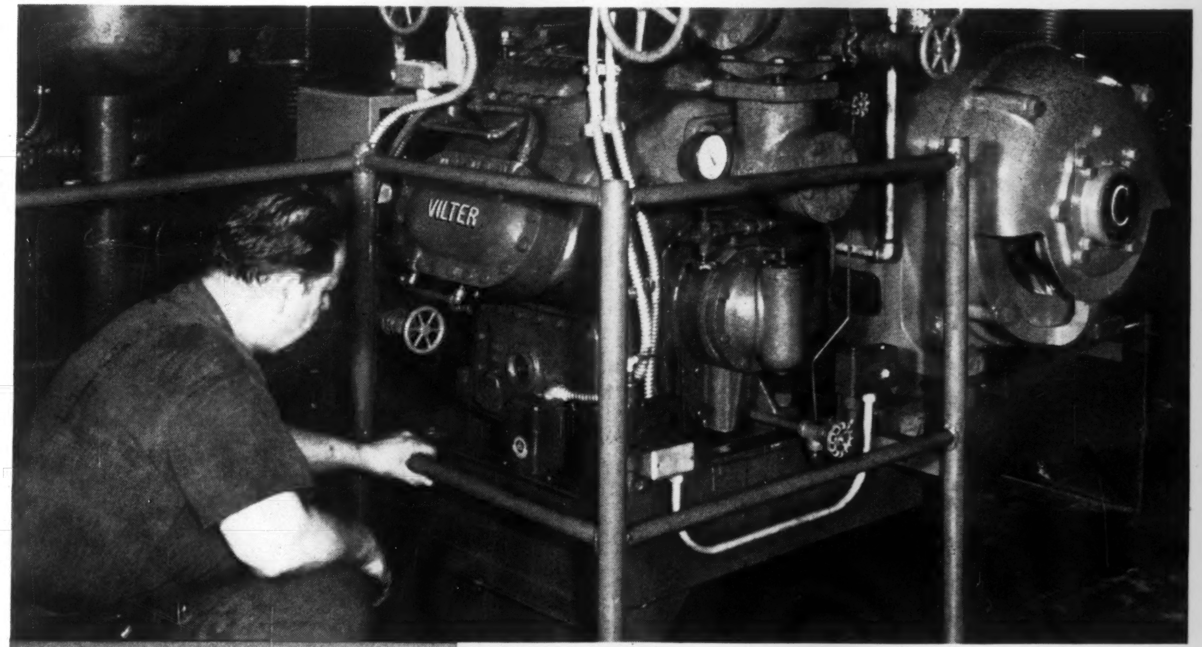
• 22 in. x 17 in. wall chart tells how to protect valves, get longer valve life—gives installation and operation pointers. Write for your copy.

R-P&C Valve Division
AMERICAN CHAIN & CABLE

Reading, Pa., Atlanta, Boston, Chicago, Denver, Detroit,
Houston, New York, Philadelphia, Pittsburgh, San Francisco,
Bridgeport, Conn.

ACCO
TRADE MARK

Get the power you need for smooth, swift compressor operation with



100 HP Century Performance-Rated type SCH Motor drives 4-stage compressor in air conditioning installation at large hotel.

Century Performance-Rated© MOTORS

Century has the motors you need . . . Performance-Rated to your *specific* applications! Here, a Century motor smoothly delivers the power for efficient compressor operation . . . with swift and easy acceleration from rest to full speed. Quiet starting and running characteristics; and where starting current must be limited, they are connectible for part winding starting. Available up to 400 HP.

You can get Century Performance-Rated Motors to fit the precise requirements of your installations: for compressors, circulating pumps, cooling towers, fans, blowers, stokers, etc. Sleeve or ball bearing; wide range of torque, speed, mountings, frames. Call or write your nearby Century District Sales Office or Authorized Distributor.

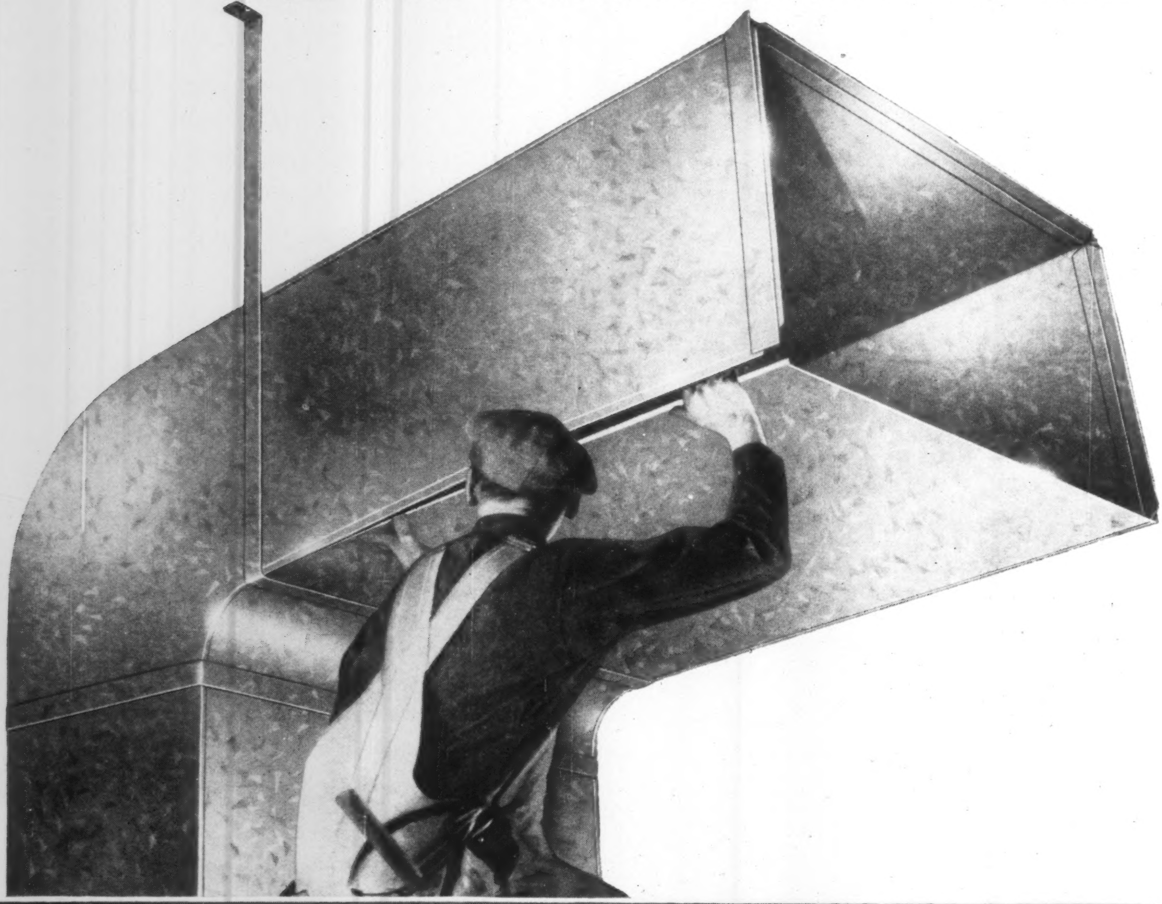
Performance-Rated ©
MOTORS
1/20 to 400 H.P.

CENTURY ELECTRIC COMPANY

1806 Pine Street • St. Louis 3, Missouri • *Offices and Stock Points in Principal Cities*

79D

Good, tight joints easy to make with USS Galvanized Steel Sheets



The uniform ductility, flatness and workability of USS Galvanized Steel Sheets pay off in ductwork jobs like the one illustrated here. They handle easily, form readily and go together smoothly to make neat, durable installations.

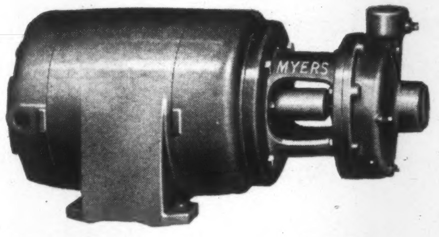
USS Galvanized Steel Sheets receive a uniform coating of zinc. They can be cut, sheared, stamped, lock seamed, soldered, rolled or bent without danger of cracking, chipping or flaking. In addition, the bright, galvanized finish adds to the attractive appearance of the job.

For information on USS Galvanized Steel Sheets, get in touch with the nearest Sales Office of United States Steel.

USS GALVANIZED STEEL SHEETS

UNITED STATES STEEL CORPORATION, PITTSBURGH • COLUMBIA-GENEVA STEEL DIVISION, SAN FRANCISCO
TENNESSEE COAL & IRON DIVISION, FAIRFIELD, ALA.
UNITED STATES STEEL SUPPLY DIVISION, WAREHOUSE DISTRIBUTORS, COAST-TO-COAST
UNITED STATES STEEL EXPORT COMPANY NEW YORK

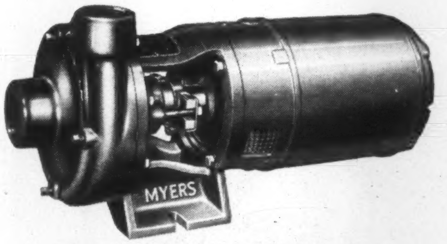
UNITED STATES STEEL



Model 150M **Model 200M**
Shown with rotary seal (available with stuffing box)

Myers Centri-Thrift Pumps for Air Conditioning

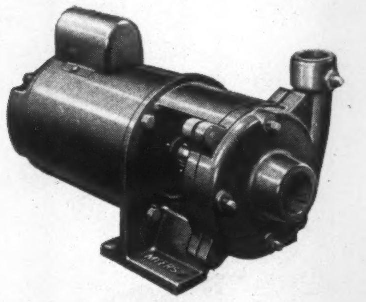
PAY OFF 3 WAYS



Model 125M **Model 150M**
Shown with stuffing box (available with rotary seal)

1 Longer Continuous Performance

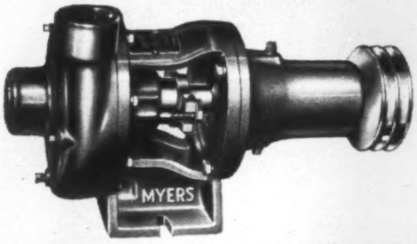
- All-bronze impeller, accurately balanced for smooth operation.
- Removable bronze wearing ring, easily replaced.
- Corrosion resistant, stainless steel shaft.
- Backed with a warranty unsurpassed in the industry.



Model 100M—Rotary seal only

2 Complete Line to Meet Any Specification

- Full range of sizes: 1" x 1¼", 1¼" x 1½", 1½" x 2", 2" x 2½", threaded discharge and suction. ⅓, ½, ¾, 1, 1½, 2, 3, 5 and 7½ horsepower, motor-mounted or belt driven.
- Regularly fitted with high quality rotary ceramic-faced seal. Stuffing box may be specified on "125", "150" and "200" models.
- Choice of motors: single or three phase, single or dual voltage, open or enclosed.
- Competitively priced.



Model 125B **Model 150B** **Model 200B**
Shown with stuffing box
(available with rotary seal)

3 Field-proven Service

- Capacities to 240 gallons per minute. Heads to 140 feet.

WRITE TODAY FOR SECTION 210 ON MYERS CENTRI-THRIFT PUMPS

Model 100B—Rotary seal only

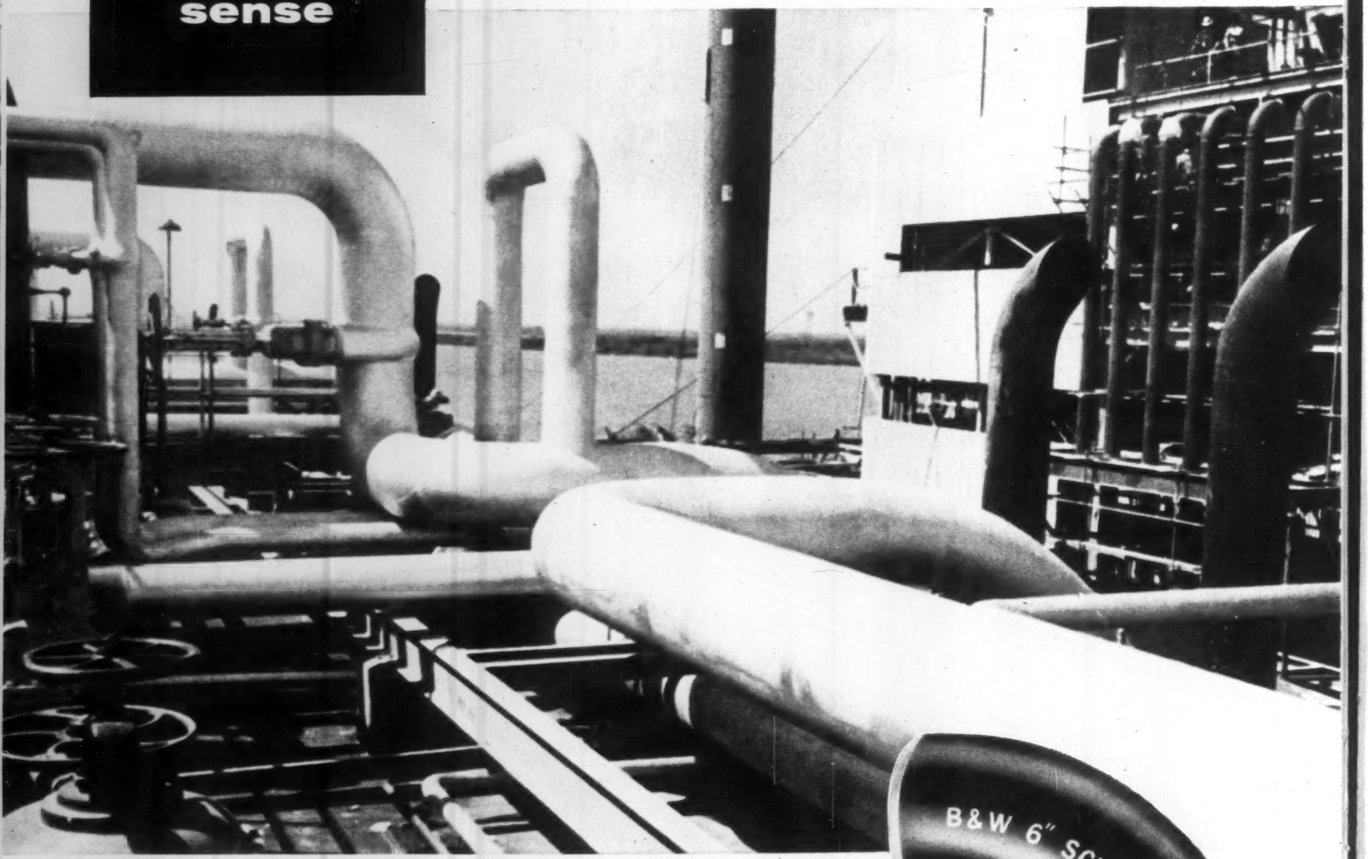
Myers® PUMPS

THE F. E. MYERS & BRO. CO. • ASHLAND, OHIO • KITCHENER, ONTARIO

Myers®

result of an engineer's good common sense

insulation is easier and faster to apply when seamless welding fittings are used



B&W 6" SCH. 40 WPB CII

THANKS to the engineer who specified B&W Seamless Welding Fittings, no humps or bumps had to be insulated here. Welding fittings became an actual part of this smooth, streamlined piping. And with a sound weld, welded connections are leakproof, pipelines are permanent. Insulation never has to be restored because of leaky joints. Therefore, maintenance is practically non-existent.

Seamless Welding Fittings combine strength with lightness-in-weight and allow closer nesting. B&W's dimensional accuracy such as full radius, true circularity and smooth walls of uniform thickness permits uninterrupted flow even under highest temperatures and pressures.

Be sure — and specify B&W Seamless Welding Fittings and Forged Steel Flanges. They're available in a complete range of sizes and types in carbon steel and the B&W CROLOYS.

THE NATURAL SOURCE FOR ALLOY FITTINGS

B&W
TUBULAR PRODUCTS DIVISION

THE BABCOCK & WILCOX COMPANY
TUBULAR PRODUCTS DIVISION • FITTINGS DEPARTMENT
3839 WEST BURNHAM STREET • MILWAUKEE 46, WISCONSIN

FA-7906-FE-2

Seamless welding fittings and forged steel flanges, seamless and welded tubular products — in carbon, alloy and stainless steels.

The Editors' Pages

Hospital Construction Up 54 Percent

. . . in first half, contracts show

STRENGTH in heavy engineering and nonresidential building pushed the construction industry to new highs in the first half of 1957, according to the F. W. Dodge Corp.

The most spectacular increase in any single building type occurred in hospitals, with contracts in this class setting a new record 54 percent ahead of last year.

Record highs were also reached by public works, public utilities, schools, commercial buildings, and religious buildings.

George C. Smith, Dodge vice president and economist, commenting on the midyear results, notes:

"As expected, 1957 is a year of heavy engineering, with the main upward boost for contracts coming from public works and public utilities.

"Only a sharp increase in government owned projects kept the total from going down instead of up.

"Inflation accounts for much of the increase in dollar volume of contracts over last year." ǂ

New Jail Cells Air Conditioned Year 'Round

. . . diffusers foil escape

EVEN THE JAIL CELLS at the new West Hollywood sheriff's station are air conditioned year 'round, according to Fred E. Schmuck of Drayer-Hanson.

The main system, a six zone type central plant unit in the basement equipment room, distributes fully conditioned air to the entire building — and each cell — through ceiling diffusers. Because the ceiling outlets provide tailor made escape hatches, a builtup protective steel plate covering guards the diffusers.

Constructed on the spot, the devices consist of stamped, perforated 3/16 in. plates, set in place with tamperproof screws embedded in concrete.

The air conditioning plant includes a 25 ton compressor, a boiler, and an evaporative condenser. ǂ

Auto Air Conditioning Double in First Quarter

. . . total compressors up 4 percent

MANUFACTURERS' shipments of compressor bodies designed for use in automotive air conditioning during the first quarter of 1957 almost doubled the figure for the same period of 1956, according to the Air-Conditioning and Refrigeration Institute.

In the first three months, total shipments of automotive compressor bodies amounted to 159,732 units, compared with 86,865 units in the first quarter of 1956, and 284,022 for the entire year 1956.

Shipments of all types of compressor bodies used in air conditioning and refrigeration units — except household refrigerators and compressors designed for ammonia refrigerant — were up about 4 percent in the first quarter, compared with last year.

Actual shipments for the three month period totaled 1,392,854 units, compared with 1,344,393 in the first quarter of last year.

Of the 1957 quarterly total, 91.3 percent of all nonautomotive compressor bodies were sold as such, or in compressors or condensing units. The remainder, 8.7 percent, were sold in unitary end-use products, such as room or selfcontained air conditioners, etc.

Shipments, broken down by categories, were as follows:

Horsepower	March 1957	Jan.-March 1957
1/5 hp & under	53,712	125,913
1/4	81,456	206,873
1/3	25,494	58,167
1/2	8,887	25,469
3/4	45,732	169,054
1	161,333	364,353
1 1/2	39,891	113,614
2	37,239	96,644
3	11,590	28,921
5	8,710	23,018
7 1/2	6,036	14,307
10	1,198	3,128
15	381	905
20	246	631
25	175	494
30 & over	599	1,641
Total	482,679	1,233,132
For ammonia, total	126	369
For automotive, total	53,924	159,732
Grand total	536,729	1,393,233

ǂ

Engineering Societies Purchase N. Y. Site

. . . for new headquarters

UNITED Engineering Trustees, Inc., which represents five national engineering societies, recently purchased for $2.7 million the major part of the blockfront on the west side of First Avenue from 47th to 48th St., in New York.

This is the first step in plans for a new headquarters building to replace the present 16 story structure at 29 West 39th St., according to W. J. Barrett, president.

Established in 1904, United Engineering Trustees consists of the American Society of Civil Engineers, the American Institute of Mining, Metallurgical and Petroleum Engineers, the American Society of Mechanical Engineers, the American Institute of Electrical Engineers, and the American Institute of Chemical Engineers. ‡

Unique Form for Tabulating Weather Data

. . . developed in Portland, Ore.

DATA to express the same or rather opposite conditions represented by degree days, for which designers of air conditioning systems long have sought, is partially supplied in three tables by Gilbert L. Sternes, climatologist of the Portland, Ore., Weather Bureau.

Table 1 lists for each month the average number of hours each 5 F temperature range was obtained during the year.

Table 2 lists the average relative humidity for each month, based on 24 hourly observations per day.

Table 3 lists the average mixing ratio for each month in grams of water per kilogram of dry air.

The data is based on the weather periods from October 1949 through June 1954, observed at the Portland airport.

While the average figures based on two to four observations are available for a considerable period, Mr. Sternes' figures present a tabulation of the persistence of temperatures based on observations made every hour of each 24 hour period. An accurate estimate of the weight of water vapor to be expected at various temperatures is also given. ‡

TABLE 1—TEMPERATURE RANGES at 5 F intervals between zero and 99 F are listed here according to frequency for each month in Portland, Ore., based on hourly observations every day from October 1949 through June 1954

Temperature Range	Jan.	Feb.	Mar.	April	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.	Annual Total
0-4	1	2											3
5-9	2	2											4
10-14	9	5									x		14
15-19	26	5									1	1	33
20-24	48	3								x	13	13	77
25-29	54	11	5	x						5	33	60	168
30-34	101	51	47	5	1				1	23	75	142	446
35-39	159	148	122	31	3				11	85	147	300	1006
40-44	158	217	224	131	34	1			28	131	217	162	1303
45-49	112	138	193	171	136	24	1	3	94	183	160	51	1266
50-54	53	77	103	173	204	137	28	32	170	170	57	15	1219
55-59	21	15	38	105	165	227	168	150	165	88	14	1	1157
60-64	x	3	10	54	93	140	176	194	88	30	3		791
65-69			1	30	53	79	122	128	63	17			493
70-74			x	15	28	58	97	103	44	7			352
75-79				4	17	30	72	60	33	4			220
80-84				1	9	15	53	40	18	1			137
85-89					1	5	19	21	5				51
90-94						3	7	11	x				21
95-99						1	1	2					4
x Occurs occasionally, but less than one hour per year on the average.											TOTAL		8765*

*Irregular total due to one February of 29 days in the five years considered.

TABLE 2—AVERAGE RELATIVE HUMIDITY for each month in Portland, Ore., is given here, based on hourly observations every day from October 1949 through June 1954

	January	Febraury	March	April	May	June	July	August	September	October	November	December	Annual total
Average relative humidity, percent	82	80	74	67	70	71	66	68	71	81	82	86	75

TABLE 3—AVERAGE MIXING RATIO, grams of water per kilogram of dry air, is given here for each month in Portland, Ore., based on hourly observations every day from October 1949 through June 1954

	January	February	March	April	May	June	July	August	September	October	November	December	Annual total
Average mixing ratio	4.58	4.22	4.76	5.22	6.50	7.88	8.92	9.19	8.23	7.12	5.51	4.90	6.42

"Quote"

"Giving the pipe fitter apprentices the fundamentals and proper 'know how' today is the only way we can be sure that the heating, piping, and air conditioning industry will have good workmen tomorrow."—*Joseph P. Corcoran, Director of Apprenticeship of the UA, at the Fourth Annual Apprentice Contest and Instructor Training Course held last month at Purdue university.*

Big Natural Spring Cuts Cooling Cost

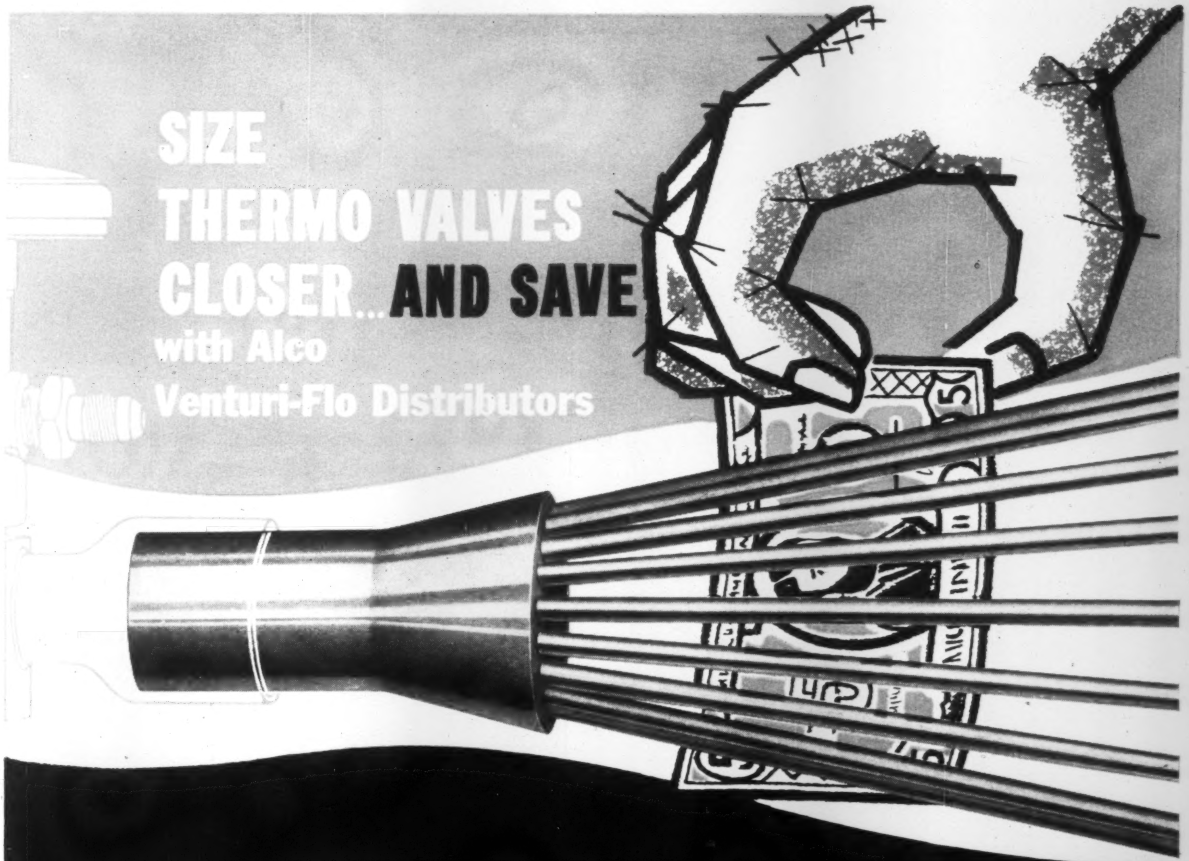
. . . supplies 60 to 62 F water

ONE OF THE LARGEST natural springs on earth is expected to cut air conditioning first costs $25 per ton of refrigeration for the new $1¼ million Electric Service Center in Huntsville, Ala., according to The Trane Co. In addition, operating cost saving will be at least 10 percent.

"Big Spring," as it is called, is at the base of a 60 ft rock wall in the center of the city. It has a daily flow of about 24 million gal, an almost unlimited supply of water at a low temperature of 60 to 62 F.

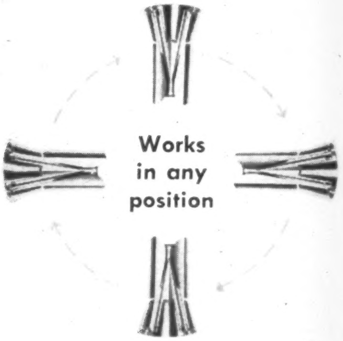
A 125 hp automatic hermetic centrifugal chiller will produce 145 tons of refrigeration at full capacity.

"The saving is achieved," says A. L. Clark, Tuscumbia, Ala., engineer, because of the plentiful spring water supply, colder than water available for systems in many cities. ‡



SIZE THERMO VALVES CLOSER... AND SAVE with Alco Venturi-Flo Distributors

TOTAL PRESSURE DROP WITH 36" OF FEEDER TUBES: 5 PSI AT 25% CAPACITY • 25 PSI AT 150% CAPACITY


Works in any position

FULL DISTRIBUTOR EFFICIENCY

No nozzles to install or size.

One Venturi-Flo replaces distributors requiring up to 6 or 7 nozzles.

Works in any position.

COMPLETE RANGE OF SIZES

See your Alco wholesaler or write for Bulletin 188-57

Buy ALCO . . . the System Shows the Difference

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ALCO VALVE CO.

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The one complete line of refrigerant controls that insures product quality: Thermostatic Expansion Valves, Refrigerant Distributors, Solenoid Valves, Suction Line Regulators, Flooded Evaporator Controls, and Reversing Valves.

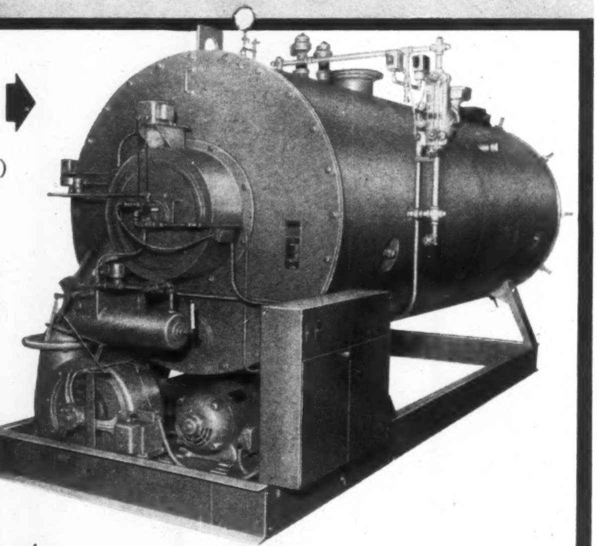
7708

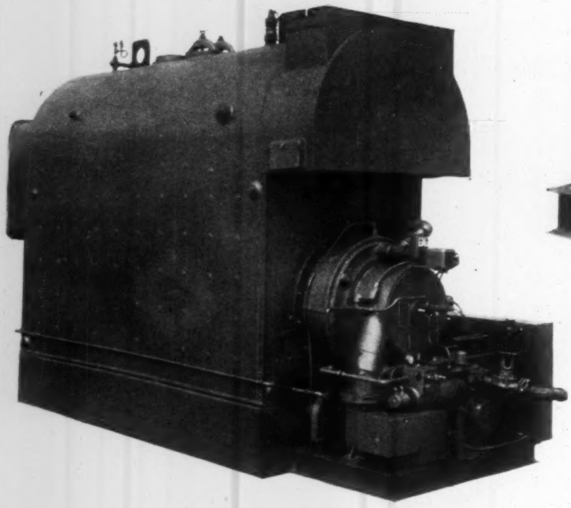
For any type or size of Automatic Boiler . . .

specify YORK-POWER

No longer are automatic boilers limited to one type of boiler. York-Power now offers a complete selection—2-pass Scotch Marines, 3-pass Scotch Marines, and 4-pass Fire Tubes —in a complete range of sizes. All York-Power boilers are automatically fired with oil or gas and can be furnished for combination gas-oil firing. All York-Power automatic boilers are complete on one skid and are fully wired. All York-Power automatic boilers are fire-tested for operational efficiency.

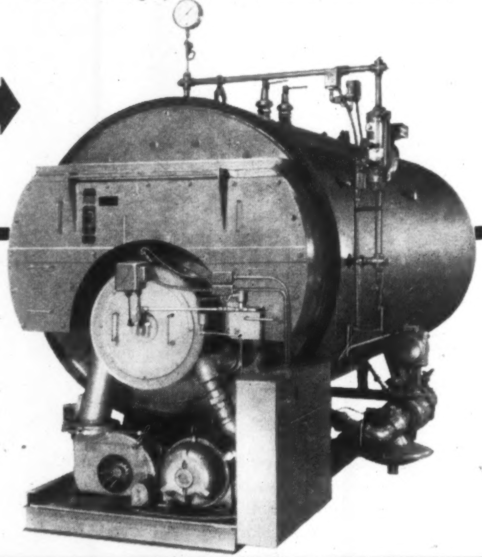
Steam-Pak Automatic Boilers
featuring 3-pass Scotch Marine design ◆ High or Low Pressure Steam or Hot Water ◆ 15 to 600 Horsepower (Also available in Steam-Pakette design from 10 to 50 h.p.)

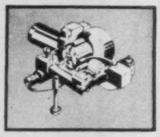




Fire-Pak Automatic Boilers
featuring 4-pass Fire-Tube design ◆ Low Pressure Steam or Hot Water ◆ 35 to 485 Horsepower (Steam-Pak firing system with forced draft burner)

Scot-Pak Automatic Boilers
featuring 2-pass Scotch Marine design with either forced, induced or natural draft. 45 to 400 horsepower





Write today for specifications on the complete York-Power line of automatic boilers

Industrial Division
YORK-SHIPLEY, Inc.
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Pioneer Specialists of Automatic Heat and Power
Also manufacturers of York-Power Burners

"Open for Discussion"

• *WE FOLLOW HERE each month the practice at engineering society meetings of providing an "open for discussion" period. You are urged to take part. Just address your comments to the Editors, Heating, Piping & Air Conditioning, 6 N. Michigan Ave., Chicago 2.*

See Insulation a Rich Investment

Considerable comment has been received on the article *Operating Records of 20 Hospitals Show Why Insulation Is a Rich Investment in Comfort, Economy*, by Charles F. Neergaard, in the June HPAC. Here is a sample of readers' comments, most of which are in strong agreement that insulation of hospitals and other large buildings pays by cutting heating installation and operating costs. What is your experience and opinion?

Consider All Factors When Planning to Insulate Hospitals

CHARLES F. NEERGAARD'S article *Operating Records of 20 Hospitals Show Why Insulation Is a Rich Investment in Comfort, Economy*, in the June HPAC, brings up questions which should be considered in planning any hospital — whether to insulate and whether to double glaze. The economics of these problems are dependent on the outside design temperature and fuel costs in the area. Also, in extreme cases, insulation may be thick enough to decrease the usable cubical contents of the building, and this initial expenditure must be added to the cost of insulation.

From the engineering standpoint, insulation is usually necessary to avoid outside wall and ceiling condensation when high winter relative humidities are to be maintained inside. In summer, insulation with considerable mass sometimes shifts the sun effect peak to a later hour, or even prolongs the effect into the late evening by absorbing and then emitting the daytime heat. Generally speaking, however, insulation will add to the patients' comfort.

Mr. Neergaard has discussed the problem of hospital insulation very well. His article should be of interest to engineers and administrators who are planning new hospital buildings.

JOHN A. HOLBROOK
Administrative Engineer
Presbyterian-St. Luke's Hospital
Chicago, Ill.

Confirms Impression of Widespread Tendency to Overdesign

THE ARTICLE *Operating Records of 20 Hospitals Show Why Insulation Is a Rich Investment in Comfort, Economy*, by Charles F. Neergaard, in the June HPAC, confirms my impression of a widespread tendency to overdesign, and a general lack of clearcut conceptions as to the optimum combination of insulation costs, capital cost of heating equipment, and operating cost. Even granting that a stable formula for the optimum combination is difficult to arrive at during a period of changing costs and new building designs, Mr. Neergaard's general position is well taken.

L. P. HERRINGTON, PH.D.
Director of Research
John B. Pierce Foundation
New Haven, Conn.

Should Be Required Reading; Waste Is Inexcusable

MR. NEERGAARD'S ARTICLE on insulation should be required reading for hospital engineers and architects. There are too many areas of accepted practice which are not based on need or reason. In these days of rising costs every expense must be examined and reexamined. Waste of any kind in a hospital plant is inexcusable, be it through the walls or up the chimney.

ALBERT W. SNOKE, M. D.
Director, Grace-New Haven Hospital
New Haven, Conn.
President, American Hospital Association

Convincing Case for Insulation; Problem Is to Kill Rule of Thumb

. . . A CONVINCING CASE for insulation and for a more measured judgment in providing radiation for hospitals. The real problem is to kill the rule of thumb which, in the past, included an excessive factor of safety.

HAROLD D. HAUF
Dean, School of Architecture
Rensselaer Polytechnic Institute
Troy, N.Y.

Give Insulation Full Consideration In Design for Buildings

There is no question that insulation should be given full consideration in design for buildings. All building construction should be carried forward with proper consideration of engineering principles with all the background and engineering research which is available with reference to proper insulation of large buildings.

Regrettably, there is a reluctance on the part of some designers and contractors to complicate their construction with insulation. Any effort toward correcting this shortsighted point of view is certainly commendable.

Newman A. Hall
Chairman
Dept. of Mechanical Engineering
Yale University
New Haven, Conn.

Becoming More Important Factor; Worth Engineer's Investigation

Insulation is increasing in the construction of buildings and is becoming daily a more important factor for comfort and economy. We have seen this for a number of years in structures which our company has built. We are not mechanical engineers so cannot comment on the savings which may be possible in reducing the size of heating and air conditioning plants. But we believe there is a possibility of this reduction. It is worth further investigation, particularly from the engineer's point of view.

John W. Harris
President
Hageman-Harris Co.
New York, N. Y.

Adequate Insulation and Proper Engineering Can Cut Costs Greatly

I think Mr. Neergaard's article on insulation is very sound as to the general concept. I would agree that if a building is adequately insulated, and if the engineering is designed to recognize such insulation, the initial cost of the heating installation and its operation should be cut down greatly.

Douglas W. Orr
Architect
New Haven, Conn.

Overall Health Economy Would Benefit By Proper Planning of Insulation

There can be little doubt that individual hospitals and the overall health economy would benefit by proper planning of the "built-in-endowments" of which Mr. Neergaard speaks. I have followed his contributions to the hospital field for many years and have found them most valuable.

J. R. McGibony, M. D.
Professor of Medical and Hospital Administration
Dept. of Public Health Practice
University of Pittsburgh
Pittsburgh, Pa.

Always a Worthwhile Investment, Repays Its Cost Many Times

I fully agree with Mr. Neergaard's presentation of the case for insulation as a means of economy of operation and also in first cost of heating installations. Insulation always is a worthwhile investment and repays its cost many times in the lifetime of a building by reduction of fuel costs, not to mention the intangible benefit of more comfortable conditions.

David M. Hummel
Mgr., Div. Engineering, Planning & Estimating
Yale University
New Haven, Conn.
Lecturer, Mechanical Equipment
Yale Dept. of Architecture

Heating Plant Reduction, Operating Economy for Other Large Buildings

I firmly believe in insulation not only because of the fuel saving in winter and the comfort in summer that comes from proper insulation but, in addition, because of the economic value it has with the life of the materials inside the building.

Also, the reduction which Mr. Neergaard shows in the size of the heating plant in an insulated building appears entirely practical. This, together with the resulting operating economy, should impress both engineers and owners, not only of hospitals, but other large buildings, of the importance of spending a proportion of their investments in better walls and windows.

William B. F. Drew
J. L. Murphy, Inc.
Heating, Piping & Air Conditioning Contractors
New York, N.Y.

Reader Asks—

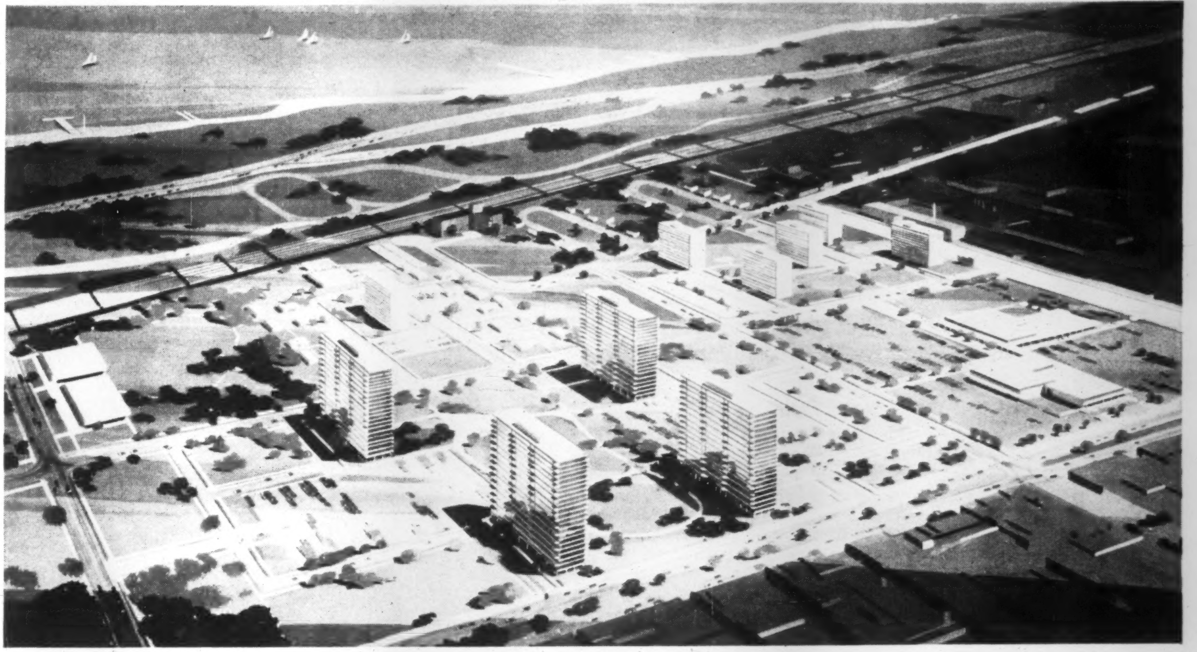
"How Fast Should Steam Lines Be Heated to Avoid Damage?"

"At what rate should long, large diameter steam lines be warmed up in order to avoid excessive pipe stresses and possible damage to the pipe?

"For instance, I have a 24 in. diameter Schedule 80 pipe 100 ft long with steam entering the pipe at 750 psi and at 720 F. At what rate should this steam be admitted into the pipe?"—C.V.

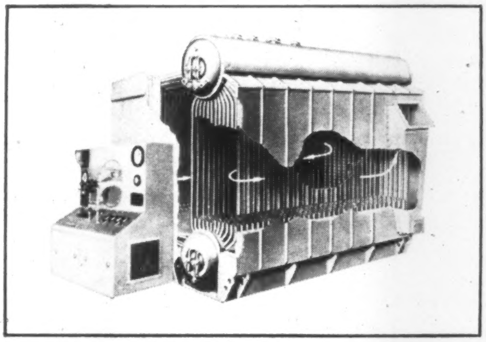
• *YOU ARE INVITED to answer this question. Write: The Editors, Heating, Piping & Air Conditioning, 6 N. Michigan Ave., Chicago 2. Answers to another question appear in Question of the Month on page 88 in this issue.*

Architect's rendering of the Lake Meadows project. Skidmore, Owings and Merrill, Architects.



Chicago's newest planned community

is served by C-E Boilers



Cutaway view of typical VP Boiler. For capacities from 4,000 to 40,000 lb of steam per hr. Pressures to 500 psi. Oil or gas fuel.

Firing aisle of the Lake Meadows boiler room showing three of the five C-E Package Boilers, Type VP.

Located on a 100 acre site overlooking Lake Michigan, Chicago's newest planned community, the Lake Meadows project, offers gracious living within the confines of a large city. Owned and managed by the New York Life Insurance Company, Lake Meadows provides distinctively appointed apartments, spacious grounds, a modern shopping center, ample parking facilities, yet is within minutes of the heart of the city. When completed, this project will house 2000 families and will include an eight acre park. Construction has already begun on a new elementary school located on two acres adjacent to the housing development.

A project of this size requires considerable steam capacity to provide ample heat and hot water as well as to perform the many other services required. To do the job, the New York Life Insurance Company originally selected three C-E Package Boilers, Type VP. Later, as new housing units were added, two additional VP Boilers were installed. Their outstanding performance and efficient, trouble-free operation is evidenced by the repeat order placed with Combustion for the final two units.

Complete information on C-E Package Boilers is available in Catalog VP-3. Write for your copy.

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ALL TYPES OF STEAM GENERATING, FUEL BURNING AND RELATED EQUIPMENT; NUCLEAR REACTORS, PAPER MILL EQUIPMENT; PULVERIZERS; FLASH DRYING SYSTEMS; PRESSURE VESSELS; SOIL PIPE

Question of the Month

What Causes Oily Soot Problem?

THE QUESTION *What Causes Soot Problem in High Pressure Air Conditioning?* was asked previously in the August HPAC. It is repeated here along with some of the answers that have been received. Other answers or comments for publication are invited. The new question is on page 86 this month.

"We have encountered an oily soot problem in our office building air conditioning system. The building consists of seven floors above a garage at grade level and below.

"The air conditioning system consists of a perimeter system for zone control, and a hot and cold deck interior system. Both systems are equipped with automatic oil type filters as well as electric precipitator type filters in series. The perimeter system air intake is at the first floor level approximately 20 ft above grade; the interior system air intake is in the penthouse on the roof.

"Oily soot of 1/16 in. diam and smaller fluffy spherical particles is discharged from the high pressure primary air ducts of the perimeter system, and from the ceiling supply units. Dust checks on the precipitators and on the cooling and heating coils fail to show any signs of the soot; target plates coated with petroleum jelly installed inside the coil and filter plenum also fail to show evidence of soot.

"Could micron size particles of soot be agglomerated into larger particles downstream of the supply fans? I would like to know what is causing this problem and how we may correct it." — W.G.M.

Excess of Charged Ions in Air May Cause Soot to Agglomerate

IT IS, of course, entirely possible that an excess of charged ions in the air cleaned by the electrostatic air cleaner may cause certain impurities to agglomerate into larger particles. Ordinarily, however, I would expect this to occur as a very fine "smudge" on ducts or other metallic surfaces which are grounded.

It is difficult for me to visualize the discharge into the air stream of particles anywhere near the 1/16 in. size referred to from this cause.

It is a relatively simple matter to determine whether there is a "space charge" in the plenum chamber, and this should be done.

If the electrostatic air cleaner is properly designed and adjusted, it should not give trouble in this respect. For that matter, the viscous filter should eliminate impurities of the size mentioned.

An air supply taken from a penthouse on the roof often has more dust than if taken at street level.

I would be inclined to check very carefully, indeed, for even the most minute leaks in the ductwork and plenum chamber.

HOWARD C. MURPHY
Consulting Engineer
Carmel, Calif.

Is Precipitator Operating at Full Efficiency? Check Other Factors

THIS PROBLEM of the unsatisfactory operation of an electrostatic precipitator appears to have no single clearcut answer. The following comments may assist in understanding this unsatisfactory condition.

As I believe the questioner suspects, fine soot particles have a definite tendency to agglomerate into larger particles. The agglomeration could take place downstream of the filters, even at the high pressure primary air duct outlets. This and the fact that even larger soot particles are often not collected on target plates because of their low density and low inertia should explain why the plenum does not show soot.

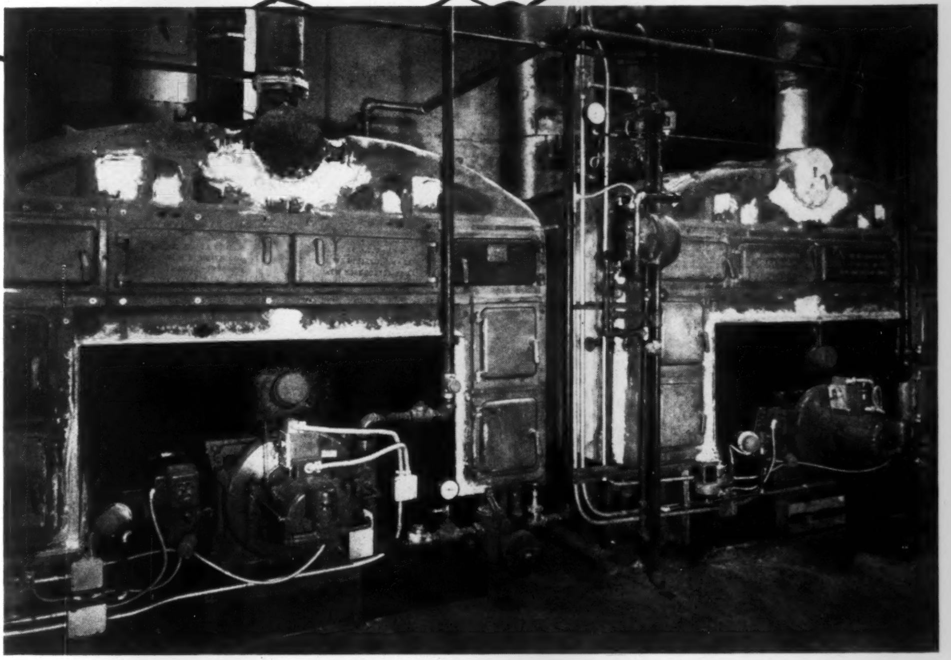
Another possibility is that the precipitator is not being coated properly with adhesive and that agglomerates of soot are blowing off the precipitator plates. Also, the oil found with the soot particles could originate as blow-off from the automatic oil filters or from the coating of precipitator adhesive or both. These conditions should be apparent upon inspection.

In any case, if the precipitator is operating properly, there should not be sufficient particles of any sort passing the filter to cause this problem. If it is not operating at full efficiency, several factors may be at fault. Is it being cleaned regularly and maintained properly? Are there broken or shorted ionizing wires?

Was it installed with good velocity distribution so that its rated efficiency is realized? We suggest that the efficiency of the precipitator be checked by the

(*Continued on page 90*)

℞ Correct Prescription for Aged Patients



. . . and H. B. SMITH LO-SETS were just what the doctor ordered!

Two H. B. Smith 16-section No. 60 boilers for hand-fired coal were installed in the Albany College of Pharmacy at Union University, Albany, New York, in 1927. Before World War II, they were converted to No. 2 oil, then re-converted to coal for the duration of the war. With No. 2 oil in plentiful supply after the war, they were again converted to that fuel. In 1956, an addition to the building necessitated an increased firing rate beyond the ability of the gun-type burners, and a change to heavy oil was decided.

Since this was to be accomplished without raising or pitting the boilers, new front sections and burner mounting plates were installed to change the boilers to two No. 60 LS 16 Smith Lo-Set types, with horizontal rotary burners for No. 5 oil. The boilers operate efficiently without the need for induced draft.

This is but one of many instances where the happy combination of extremely long life and convertibility of H. B. Smith boilers has effected important savings for the user.

H.B. Smith CAST IRON BOILERS

H. B. SMITH CO., INC., WESTFIELD, MASSACHUSETTS • *Established 1853*

(Continued from page 88)

National Bureau of Standards discoloration method. This test will show up dirt penetration even in submicron sizes.

One last possibility is that the ducts downstream of the precipitator may have become loaded with dirt during some period of inefficient operation of the precipitator or while it was shut down because of maintenance difficulties. Agglomerates of this dirt might now be becoming resuspended in the supply air. In any case, now that positive strainer type filters are available with low pressure drops and the same efficiency as the rated performance of precipitators, these difficulties can be completely avoided.

Paul M. Engle
Manager, Research & Development
Cambridge Filter Corp.
Syracuse, N. Y.

Not Caused by Air Filters; Maybe Ducts Were Dirty Before

I am sure there will be no disagreement that the soot problem is not attributable to the air filters. With electrostatic filters in the system, it is unlikely that enough carbonaceous material could pass to later agglomerate into large fluffy particles.

No mention is made as to when this condition appeared after the system was installed. Possibly the ducts were dirty before the air filters were installed. Another possibility, perhaps remote, is that dirty air is entering the office without passing through the filters, i.e. through doors, windows, or cracks.

W. B. Watterson
Vice President
Air-Maze Corp.
Cleveland, Ohio

Lists Probable Sources, Offers Possible Solutions

Before proposing a solution to the problem we should first try to establish the cause. Fairly large sized dirt particles or agglomerates are being discharged from the duct systems into the conditioned space.

I. *Probable Sources.*

a) Is the duct system an old one, subjected to years of dust accumulation, perhaps at much lower air velocity and perhaps without adequate air cleaning? Such a duct system, especially if subjected to increased air velocity, might deliver agglomerates for years, regardless of the performance of air cleaners currently used at the source.

b) Are very fine particles passing the filter and coils, and agglomerating before being discharged into the space? If such agglomeration were occurring it would almost certainly be the result of impingement or thermal and electrical precipitation on duct walls and subsequent dislodgment of agglomerates from those walls. This is unlikely if the prefilter and electrostatic precipitator are functioning properly.

c) Is the filter system letting agglomerates pass into the ducts? Target plates showed no agglomerates, but were the targets exposed during or immediately preceding and following filter maintenance? Many conditions may exist temporarily in apparently properly functioning filters that contribute to passing of agglomerates. For example:

1) Washable plate type precipitators can become overloaded with dirt and pass copious quantities of agglomerates with every sparkover between plates.

2) Rear screens of automatic type precipitators can, over a prolonged period of time, become overloaded with dirt to the extent that handling and vibrations of these screens will cause dislodging of agglomerates. Source of dirt on these screens usually is not from malfunction of the precipitator but is from normal sparkover that dislodges dirt from plates.

3) Backup filters frequently used with washable precipitators may become loaded to the extent that handling and vibration cause dislodgment of agglomerates.

If the particulates that are reaching the space are agglomerates, they are not of a size or character that would escape capture in both the prefilter and the precipitator. Assuming that a, b, and c as discussed above represent the likely sources of the observed dirt, let us consider the possible solutions.

II. *Possible Solutions.*

a) Installation of filters at discharge to collect agglomerates. This is usually impractical if not impossible as space is never available and velocities are too high.

b) If duct system is old and problem became manifest with change in air velocity, thorough cleaning of the ducts alone most likely would cure the job.

c) If duct and filter system have been associated from the start, and especially if the problem did not exist from the start but developed gradually, then:

1) Provide better maintenance for the precipitators.

a) If precipitators are washable type, wash and oil more frequently.

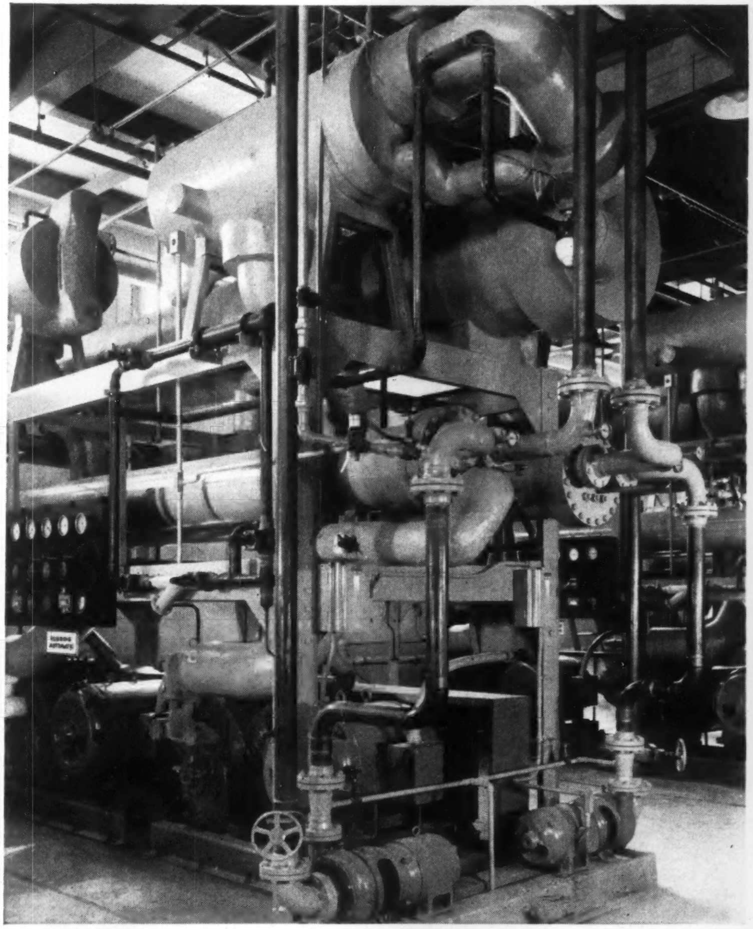
b) If precipitators are automatic type, wash rear screens.

2) If backup filters are used, make sure that they never become overloaded. Service or replace them more frequently.

3) If backup filters are not used, they should be added. Pleated dry type filters are recommended but if space or economic considerations do not permit them, then adhesive coated disposable glass filters may be used. If impingement type filters are used to back up the precipitator as contrasted to dry types, then the impingement units must be adhesive coated.

Impingement type filters operated without adhesive will pass agglomerates and large particles readily and may eventually add to the problem.

Robert F. Logsdon
Asst. Director of Research
American Air Filter Co., Inc.
Louisville, Ky.



AUTOMATICALLY CONTROLLED supply of −40°F ammonia for process use is produced in ammonia reflux system (left). Two duplex 150 hp Worthington reciprocating compressors are used for low temperature brine system (right). All heat exchange equipment was supplied by Patterson-Kelley.

HOFFMANN-LaROCHE

calls on reliability, efficiency of

P-K EQUIPMENT

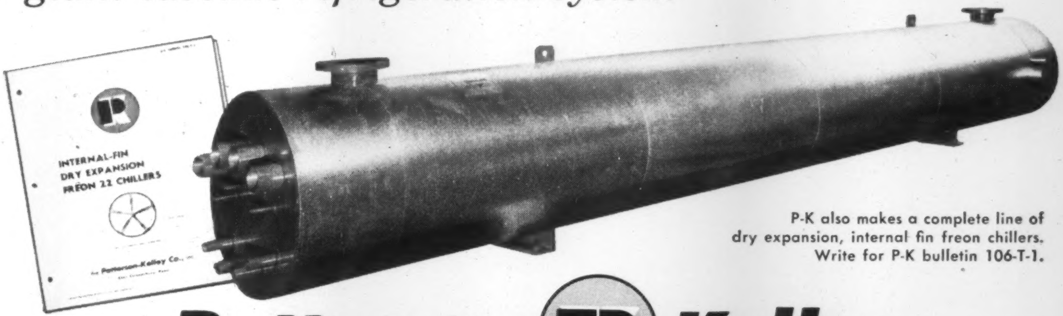
for giant cascade refrigeration system

One of the largest automatic cascade refrigeration systems ever built is now operating full-time at the Hoffmann-LaRoche plant in Nutley, New Jersey. This system with 2000-H.P. capacity provides −40°F ammonia and 10°F brine for special process work. Exchangers contain 73,590 feet of tubing. Photo shows one of 4 duplex brine units (4 duplex and 1 single low temperature unit not shown).

In addition, the system offers a unique answer to one of the most complex problems in the refrigeration industry: to provide, automatically, a continuous supply of accurately controlled low temperature ammonia. This was made possible by the use of P-K balance loaders and slug eliminators.

The system, designed by Mr. J. W. Obreiter, Jr., consulting engineer of Hoffmann-LaRoche, is made up of an ammonia reflux system and a low temperature brine system.

Next time your system demands efficient, trouble-free heat transfer performance, it will pay you to call in Patterson-Kelley. For details on the exact equipment to fit your needs, write the Patterson-Kelley Co., Inc., 119 Burson St., East Stroudsburg, Pa.



P-K also makes a complete line of dry expansion, internal fin freon chillers. Write for P-K bulletin 106-T-1.

Patterson Kelley

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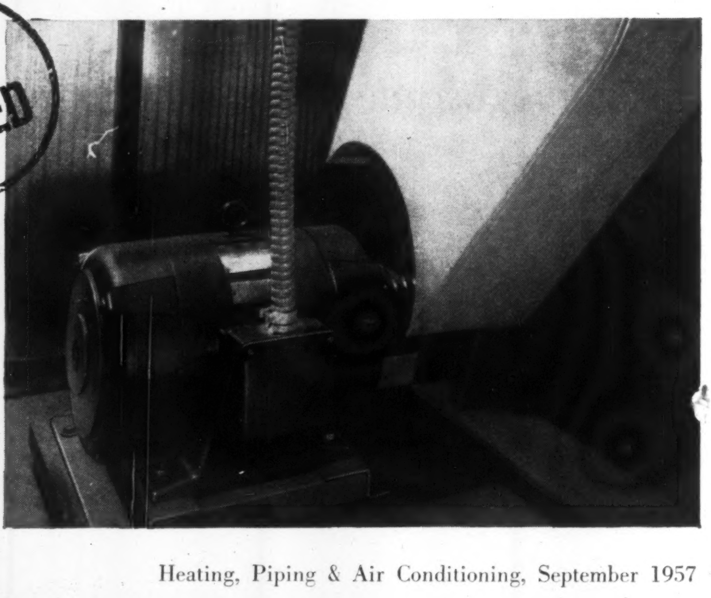
3 for 99¢
3 for 99¢

At This Kresge Store . . .

Westinghouse Life-Line A motors have

JOB TESTED

This busy self-service Kresge store, located in Ross Township, Pennsylvania, relies on Westinghouse Life-Line "A" motor-powered central air-conditioning to keep customers cool and comfortable while the temperature climbs outside.



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proved outstanding for air conditioning

Westinghouse motors have been thoroughly tested in tough air-conditioning jobs like this . . . and have proven outstanding for quiet, long-term, dependable performance.

The Life-Line "A"® is built for rugged duty, with an amorized frame to assure proper alignment and protect against physical abuse. Ventilation openings in end brackets make the Westinghouse Life-Line "A" motor completely drip-proof, regardless of mounting position. 4-way sealed, prelubricated bearings keep grease in . . . dirt and water out . . . eliminates on-the-job greasing in out-of-the-way applications.

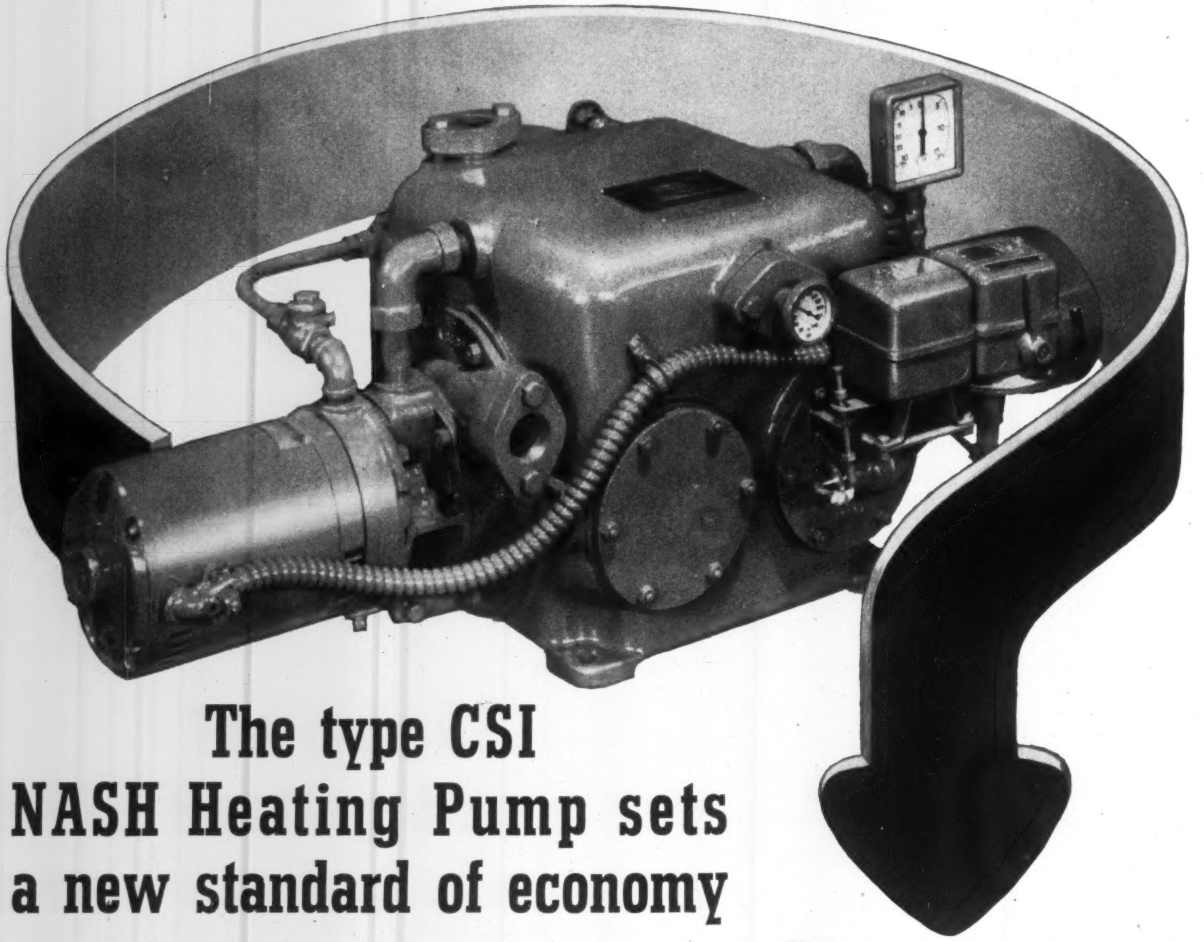
Tests in soundproof laboratories have proven that Life-Line "A" motors, through precision manufacture and dynamic balancing, are producing an operating sound level lower than any other standard motor.

FOR COMPLETE INFORMATION, on these Westinghouse air-conditioning motors, call your Westinghouse sales engineer or distributor. Or, write Westinghouse Electric Corporation, P.O. Box 868, 3 Gateway Center, Pittsburgh 30, Pennsylvania.

J-22057

YOU CAN BE SURE . . . IF IT'S Westinghouse

It's a NASH Heating Pump, PLUS!



The type CSI NASH Heating Pump sets a new standard of economy

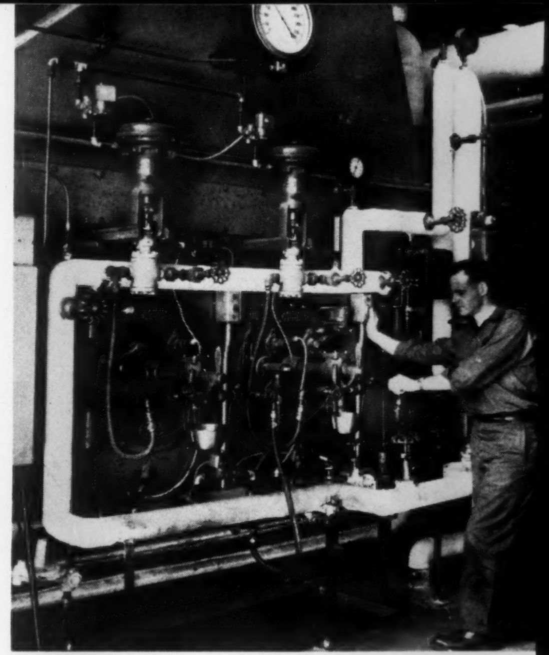
Now a Nash quality Vacuum Heating Pump can be economically installed and operated on any steam heating job. Engineered for high performance and low installed first cost, this new pump still makes use of time tested Nash principles of operation.

The Nash CSI has generous air capacity and features a wide choice of water capacities and discharge pressures. The right combination of capacities is at hand to match the requirements of the job. It is no longer necessary to pay extra for a pump with excessive water capacity, excessive discharge pressure, or in an attempt to get adequate air capacity.

With this advanced design, Architects, Engineers and Contractors will find answers to many heating system problems. Send for bulletin now.

1. **ECONOMY IN FIRST COST**
2. **ECONOMY OF INSTALLATION**
3. **ECONOMY OF OPERATION**
4. **ECONOMY OF MAINTENANCE**

NASH ENGINEERING COMPANY
449 WILSON, SO. NORWALK, CONN.



TWO GENERATORS, one of which is shown, heat water from 246 F inlet temperature to 426 F for circulation through the closed system. Units are rated 40 million Btu per hr each

Multiple Plant's HTHW System...

- ***provides direct heating***
- ***supplies low temperature hot water***
- ***furnishes process steam***

IMPRESSED with the efficiency and low installation and operating cost of high temperature, high pressure hot water in an earlier plant application, Johnson & Johnson specified the same type of heating system for its new manufacturing center at North Brunswick, N. J., the world's largest surgical dressings plant.

Design of the new center was based on efficiency and for expansion. Three main buildings, arranged diagonally on the site and connected by smaller office and laboratory structures, and a separate cafeteria building comprise the 630,000 sq ft plant.

The buildings are, in general, single story structures of structural steel frames with concrete block exterior walls finished in white stucco. All three buildings contain large wall areas of blue glass.

Length of the distribution system was a contributing factor in selecting high temperature hot water for this plant. The main plant buildings are long and low, extending almost a half mile in length on a 300 acre site. Total length of system piping is several miles, with the furthest unit over 3000 ft from the boilers.

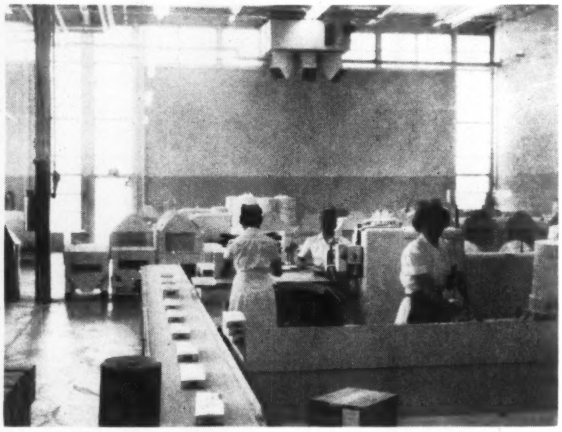
The water is circulated at temperatures from 246 to 426 F. Distribution is in the following ways: high temperature hot water; as lower temperature water, using heat exchangers; or as steam, using flash converters.

System design includes the use of two forced recirculation hot water generators. Rated at 40 million Btu per hr each, the two units are designed to heat water from 246 F inlet temperature to 426 F for circulation through the closed plant system. Each generator is equipped with a forced recirculation pump which delivers water at a velocity of 6 to 8 fps through internal generator tubes.

Average absorption in each generator is 10,000 Btu per sq ft per unit of heating surface. In addition, generators contain an economizer section in which the return water is raised close to saturated temperature by the flue gases before reaching the generator walls.

Three 30,000 gal fuel oil tanks supply the generators, each of which contains its own mechanical atomizing burner. The generating system also incorporates a welded steel expansion tank to permit the water volume to adjust to temperature fluctuations.

PLASTER MILL OFFICES, left, as well as all other offices, lunch rooms, the cafeteria building, and some manufacturing areas are air conditioned



HEATING UNITS utilize hot water directly such as this one in the baby products plant

an emergency break in the makeup feed line, the deaerator may be supplied from a 1000 gal storage tank.

Total Heating Load Is 63 Million Btu Per Hr

From the generators and expansion tank, 426 F hot water is pumped under 426 psig pressure to the system. Three circulating pumps — one for each generator and one standby — distribute the water at the rate of 210,000 lb per hr. Circulating pumps are horizontal, end suction, top discharge type, cooled by an injection and leakoff system. The pump discharge water, cooled to 200 F in a heat exchanger using cooling tower water, is injected into the pump packing glands. The pumps are driven by oversize 50 hp motors to preclude overloading.

Total calculated load of the plant heating system is 63 million Btu per hr, of which 12 million Btu per hr is for process heating. For most of the year, it is estimated that one generator will carry the full load, with the other serving as standby. Provision for future plant expansion has also been included: space is provided for a third generator, and a fourth circulating pump with all the allied equipment.

Hot Water Used Three Ways

Hot water is used in three ways throughout the plant: direct, through coils; as low temperature hot water; and as steam for process work.

In general, the conversion to low temperature water or steam is made through heat exchangers near using facilities. Heat exchangers are of the shell and tube type; high temperature hot water circulates through coils in the shell and heats the water contained in the shell under vapor pressure to the desired temperature. A temperature control valve with the bulb immersed in the shell water maintains the desired temperature by measuring shell water temperature and automatically adjusting incoming hot water flow as desired.

Wherever possible within the plant, hot water is used direct, through coils. The hot water is used directly in all heating and ventilating units, unit heaters, the cooling tower, and in air conditioning equipment in parts of the plaster mill. Lower temperature hot water is used for perimeter heating, at the gravity tank, to prevent freeze-up; and for process heating. Low temperature hot water also circulates through the coils in fuel oil tanks by maintaining the oil suction temperature to the oil heaters at 120 F maximum. Flash converters provide steam where required in the cafeteria and for some process work.

Pipe Welding Rigidly Controlled

Piping for the hot water system required careful welding control because of the high pressures involved. While American Society for Testing Materials A-106 carbon steel piping was specified for the system, it proved to be unavailable. By rigid control of welding specification and inspection standards, a more economical grade of steel was able to be used and still maintain the necessary piping qualifications. Eight in. diam pipe is installed between the generators and the expansion tank, 10 in. pipe to the circulating pumps, and 5 to 6 in. pipe for most of system piping mains. Distribution system piping is overhead, supported by brackets from roof trusses.

Heating, Ventilating Units Save Space

In order to preserve storage space in the 285,000 sq ft shipping center building, heating and ventilating units are in skylight monitors. Four monitors, 6 × 13 ft, traverse the building at 80 ft intervals. Heating and ventilating units, 8 × 8 × 3 ft, are spaced 125 ft apart on centers in each monitor, suspended from the monitor roof. A catwalk around each unit provides space for maintenance. Outdoor air is drawn through ducts fed from louvers in the montitor wall, filtered, and discharged past hot water coils. Face and bypass dampers have been designed into each unit to aid in acquiring the air temperatures required.

In all, 23 heating and ventilating units are in the shipping center, approximately 50 in the entire plant. Units in the manufacturing buildings are mounted both in monitors and directly on walls.

Propeller type unit heaters, equipped with high temperature hot water coils, are installed at freight and loading docks and in personnel areas in manufacturing and storage sections of the plant. Heaters at loading areas are controlled by an automatic switch which turns the heaters on when loading doors open.

Controls Coordinate Oil Flow

Control of hot water generator output and efficiency is quite complex, because of the demand lag and the transit time in the generator. The primary control problem is to maintain a constant outlet temperature without causing the generator to produce steam.

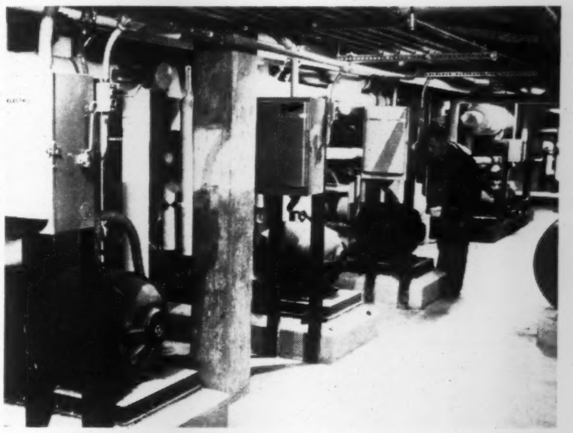
The hot water system is controlled as follows. The primary control is a calculating master which takes into account return water temperature and expansion tank pressure, as well as the temperature of the water leaving the generator. The calculating master sends a pneumatic signal which simultaneously positions the fuel oil valve in the return oil line and the forced draft fan damper. Two area type fuel oil meters, subtracting pneumatically, coordinate the net oil flow to the burners with air flow through the generator. The resulting signal readjusts the fuel oil valve to maintain optimum combustion conditions. The positioners on the oil valve and the forced draft control assure rapid, positive positioning and accurate paralleling.

The desired boiler pressure is maintained by an independent combination boiler pressure controller and uptake damper control. In addition, the generators are protected by flame failure and safety equipment.

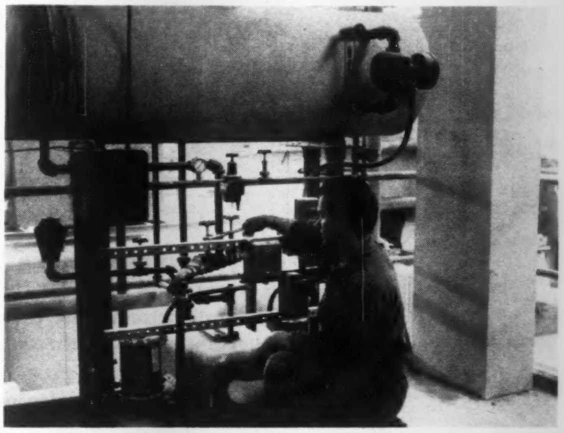
To prevent tube damage at low heat outputs, a minimum flow of water through the boiler is regulated by a single system bypass valve actuated from return water flow transmitters. A selective relay picks up the generator with the lowest flow and keeps it above the minimum rate.

All metering and control information on the control board is pneumatically transmitted, one signal being used for both control and metering. All recorded information for each generator is on two instruments: one records outlet water temperature, return temperature, and return flow, and the other records net oil flow, air flow, and flue gas temperature. A fifth calculator records Btu per hr output of both generators by measuring entering water temperature, leaving water temperature, and total flow. The results are summarized on a chart. All normal control functions are at one station for convenience and safety of operation.

The system was designed by Walter Kidde Constructors, Inc. The heating contractor was the Richardson Engineering Co. ‡

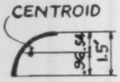


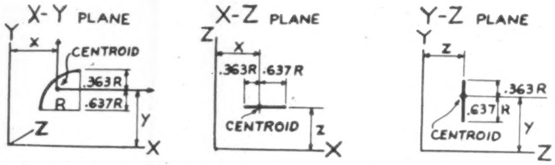
CIRCULATING PUMPS contained in an auxiliary systems room — beneath the boiler room proper — are cooled by an injection and leakoff system and driven by oversize motors



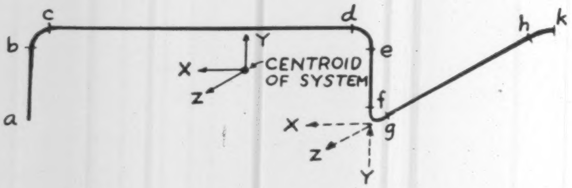
STEAM CONVERTER in the orthopedics processing plant is typical of the heat exchangers used. Unit converts HTHW to low pressure steam for use by calorimeter

SKYLIGHT MONITORS house heating and ventilating units in the shipping center to allow more storage space. Catwalk and entrance through window facilitate maintenance

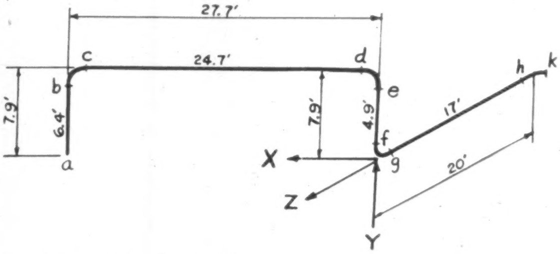




2 ELBOW PARALLEL TO THE X-Y PLANE requires, because of increased flexibility, use of a virtual length in calculating line inertias in the plane of elbow



1 ORIGINAL AXES are chosen so that two axes are in a plane containing the most branches, while the third is colinear with a branch perpendicular to this plane, as shown in this system. By thus reducing many coordinate values in Table 1 to zero, time and labor for calculations are cut



3 BRANCHES IN TORSION in each perpendicular plane (branches perpendicular to the plane) are increased 30 percent in numerical value to allow for their torsional effect on flexibility

Calculating Pipe Stress Efficiently

. . . this procedure based on the 1955 American Standard Code for Pressure Piping saves time and work. The most significant factors include:

1) The application of the flexibility factor *K* and the stress intensification factor *i* (applied to all three perpendicular planes, instead of only the plane of elbow).

2) The formulas and calculation of: the above factors *K and i*; characteristic factor *h*; allowable stress (stress range); maximum expansion stress; force and moment ranges; and hot and cold reactions.

3) The phenomenon of self springing.

BY K. HAO HSIAO
Consultant for Piping Stress Analysis

PIPING SYSTEMS, as part of the equipment of modern pipe line stations, chemical plants, and refineries, and other installations are subjected to high temperatures, pressures, and corrosive conditions. Thus, in order to prevent failure of equipment and withstand the great stresses due to thermal expansion, piping stress analysis has become increasingly important.

Piping stress calculation by conventional procedure is a tedious process, prone to error: the analyst must face the monotony and labor of computing many rows and tables of figures, and go through the mechanical routine of solving simultaneous equations for each piping system. A fatal error in signs, which would require complete repetition of calculations, must be avoided.

The procedure presented here is for the efficient and time saving tabulation and calculation of forces, moments, and stresses in:

1) A three dimensional piping system with elbows.

2) A single plane system subjected to expansion perpendicular to its own plane.

3) A single plane system with expansions in its own plane.

4) A square cornered system, a system containing mitres or a system with piping of different diameters.

Three Dimensional Piping Systems. Consider the following piping system, shown in Fig. 1:

Assume end *a* as fixed and end *k* as tending to expand. (All piping systems in this article are assumed to be fixed at both ends — for flexibility — where forces, moments, and torques occur. However, one end of each system is shown as temporarily free to expand in order to determine the directions of forces *X*, *Y*, and *Z* resisting ex-

		DESIGNATION	x	y	z	L^3	L	Lx	Lx^2	Ly	Ly^2	Lz	Lz^2	Lxy	Lxz	Lyz
BRANCH ∥ Z		gh	0	0	−10	4,913	17	0	0	0	0	−170	1700	0	0	0
	(1)	SUM				I_1 4,913	17	0	0	0	0	−170	1700	0	0	0
	(2)	(1)×0.3					5.1	0	0	0	0			0		
BRANCH ∥ Y		ab	27.7	3.2	0	262.1	6.4	177	4900	20.5	65.5	0	0	566	0	0
		ef	0	3.95	0	117.6	4.9	0	0	19.4	76.5	0	0	0	0	0
	(3)	SUM				I_2 379.7	11.3	177	4900	39.9	142.0	0	0	566	0	0
	(4)	(3)×0.3					3.4	53.1	1470			0	0		0	
BRANCH ∥ X		cd	13.85	7.9	0	15069	24.7	342.0	4740	195.2	1543	0	0	2700	0	0
	(5)	SUM				I_3 15069	24.7	342.0	4740	195.2	1543	0	0	2700	0	0
	(6)	(5)×0.3					7.4			58.6	463	0	0			0
ELBOWS ∥ XY		bc					L = 1	27.16	737	7.36	54.2	0	0	200	0	0
		de						.54	.3	7.36	54.2	0	0	4	0	0
	(7)	SUM					NO. ELLS 2	27.70	737.3	14.72	108.4	0	0	204	0	0
	(8)	(7)×β					45.2	62.5	16,680	333	245.0			4610		
ELBOWS ∥ XZ		hK					L = 1	−.54	.3	0	0	−19.46	378	0	10.5	0
	(9)	SUM					NO. ELLS 1	−.54	.3	0	0	−19.46	378	0	10.5	0
	(10)	(9)×β					22.6	−12.2	7			−440	8540		237.3	
ELBOWS ∥ YZ		fg					L = 1	0	0	.54	.3	−.54	.3	0	0	−.3
	(11)	SUM					NO. ELLS 1	0	0	.54	.3	−.54	.3	0	0	−.3
	(12)	(11)×β					22.6			12.2	7	−12.2	7			−7
	(13)	(7)+(9)+(11)					4	27.16	737.6	15.26	108.7	−20	378.3	204	10.5	−.3
	(14)	(13)×α					99.5	675	18,400	380	2,705	−498	9,420	5,080	261.5	−7.5
BASIC SUM	(15)	(1)+(3)+(5)+(14)					152.5	1,194	28,040	615.1	4,390	−668	11,120	8,346	261.5	−7.5
XY	(16)	Σ=(2)+(8)+(15)					202.8	1,819	44,720	948.1	6,840			12,956		
	(17)	(16)÷ΣL						$\bar{x}$ 8.97		$\bar{y}$ 4.67						
	(18)	(17)×Σ						$\bar{x}\Sigma Lx$ 16,310		$\bar{y}\Sigma Ly$ 4,430				$\bar{y}\Sigma Lx$ 8,510		
	(19)	(16)−(18)						I'_y 28,410		I'_x 2,410				I_{xy} 4,446		
XZ	(20)	Σ=(4)+(10)+(15)					178.5	1,234.9	29,517			−1,108	19,660		498.8	
	(21)	(20)÷ΣL						$\bar{x}$ 6.92				$\bar{z}$ −6.2				
	(22)	(21)×Σ						$\bar{x}\Sigma Lx$ 8,550				$\bar{z}\Sigma Lz$ 6,880		$\bar{z}\Sigma Lx$ −7670		
	(23)	(20)−(22)						I'_z 20,967				I''_x 12,780		I_{xz} 8,168.8		
YZ	(24)	Σ=(6)+(12)+(15)					182.5			685.9	4,860	−680.2	11,127			−14.5
	(25)	(24)÷ΣL								$\bar{y}$ 3.76		$\bar{z}$ −3.73				
	(26)	(25)×Σ								$\bar{y}\Sigma Ly$ 2,580		$\bar{z}\Sigma Lz$ 2,540			$\bar{z}\Sigma Ly$ −2,560	
	(27)	(24)−(26)								I''_z 2,280		I''_y 8,587			I_{yz} 2,545.5	

LINE DATA
12" DIAM. SCH. 10S
STAINLESS TYPE 304

D	12.75"	Δ_y	0
t	0.180"	Δ_z	2.62
I	140.5	h	0.082
S	22	K	20.1
T	1125 °F	L_a	2.35
e	13.1	i	4.77
E_h	21.6×10^6	α	10.6(2.35) = 24.9
E_c	27.4×10^6	β	9.6(2.35) = 22.6
Δ_x	4.1		

COEFFICIENTS

$-\frac{I_{xy}}{I_x} = -\frac{4,446}{15,632} = -.285$ Ⓐ $-\frac{I_{xz}}{I_x} = -\frac{8,169}{15,632} = -.523$ Ⓑ $\frac{\Delta_x E_c I}{I_x 1728} = \frac{4.1(27.4)10^6(140.5)}{15,632(1,728)} = 585$ Ⓒ ---- (a)

$\frac{I_y}{I_{xy}} = \frac{38,664}{4,446} = 8.7$ $-\frac{I_{yz}}{I_{xy}} = -\frac{2,546}{4,446} = -.573$ $\frac{\Delta_y E_c I}{I_{xy} 1728} = 0$ ---- (b)

$-\frac{I_{yz}}{I_{xz}} = -\frac{2,546}{8,169} = -.312$ $\frac{I_z}{I_{xz}} = \frac{24,530}{8,169} = 3$ $\frac{\Delta_z E_c I}{I_{xz} 1728} = \frac{2.62(27.4)10^6(140.5)}{8,169(1,728)} = 715$ ---- (c)

I'_x 2,410	I'_y 28,410	I'_z 20,967
I''_x 12,780	I''_y 8,587	I''_z 2,280
$I_{1/12}$ 410	$I_{1/12}$ 410	$I_{2/12}$ 32
$I_{2/12}$ 32	$I_{3/12}$ 1,257	$I_{3/12}$ 1,257
I_x 15,632	I_y 38,664	I_z 24,536

FORCES FROM COEFFICIENTS

(1)	(a)+(b)	8.415	−1.096 Ⓓ	585
(2)	(a)+(c)	−.597	2.477 Ⓔ	1,300
(3)	(2)× −Ⓓ/Ⓔ	−.264 Ⓕ	1.096	575 Ⓖ
	(1)+(3)	8.151 Ⓚ	0	1,160 Ⓛ

$$Y = \frac{\textcircled{L}}{\textcircled{K}} = \frac{1,160}{8.151} = 142$$

$$Z = \frac{\textcircled{G} - \textcircled{F}Y}{-\textcircled{D}} = \frac{575 + .264(142)}{1.096} = 560$$

$$X = \textcircled{C} - \textcircled{A}Y - \textcircled{B}Z = 585 + .285(142) + .523(560) = 919$$

TABLE 1—MOMENTS AND PRODUCTS OF INERTIA for forces X, Y, and Z are tabulated here for the piping system shown in Fig. 3

pansion at that end. These forces are transferred to the centroid of system, where there is no moment or torque.) Then, the forces *X*, *Y*, and *Z*, which restrain the end *k* and prevent it from expansion, are transferred to the centroid of the system (behind *abcdef* plane), forming the centroidal axes of the system. In actual computation, however, the original axes are used instead of the centroidal axes.

As shown by dotted lines in Fig. 1, the original arbitrarily chosen axes are such that two of the axes are in a plane containing the greatest number of branches, while the third axis is colinear with a branch perpendicular to this plane. Such a selection reduces many coordinate values in Table 1 to zero, thereby cutting down the time and labor required for calculations. The X, Y, and Z forces are obtained from the following equations from *Piping Stress Calculations Simplified*, by W. S. Spielvogel:

$$XI_x - YI_{xy} - ZI_{xz} = (\Delta xEI)/1728 \quad \ldots\ldots\ldots\ldots[1]$$

$$-XI_{xy} + YI_y - ZI_{yz} = (\Delta yEI)/1728 \quad \ldots\ldots\ldots\ldots[2]$$

$$-XI_{xz} - YI_{yz} + ZI_z = (\Delta zEI)/1728 \quad \ldots\ldots\ldots\ldots[3]$$

Dividing Equations 1, 2, and 3 by line inertias I_x, I_{xy}, and I_{xz} respectively, and using E_c for E, according to the 1955 American Standard Code for Pressure Piping, we obtain:

$$X - Y(I_{xy}/I_x) - Z(I_{xz}/I_x) = (\Delta_x E_c I)/(1728 I_x) \quad \ldots[4]$$

$$-X + Y(I_y/I_{xy}) - Z(I_{yz}/I_{xy}) = (\Delta_y E_c I)/(1728 I_{xy}) \quad \ldots[5]$$

$$-X - Y(I_{yz}/I_{xz}) + Z(I_z/I_{xz}) = (\Delta_z E_c I)/(1728 I_{xz}) \quad \ldots[6]$$

Calculation of Line Inertias. The calculation of line inertias in Equations 4, 5, and 6 is based on Equation 7, and the operations are tabulated in Table 1, Example 1, shown in Fig. 3. The solution for X, Y, and Z forces is also given in Table 1. The calculations of coordinates $\vec{x}$ and $\vec{y}$ of the centroid of the system in XY plane with respect to the original axes are based on the last two equations in Equation 7, and those in other planes are obtained in a similar manner.

Plane Equation

$$XY \quad I_x' = \alpha \sum_{i=\text{all elbows}} y_i^2 + \beta \sum_{i=\text{elbows} \parallel \text{plane}} y_i^2 + \sum_{i=\text{all branches}} L_i y_i^2 + 0.3 \sum_{i=\text{branches} \perp \text{plane}} L_i y_i^2$$

$$-\bar{y}\left[\alpha \sum_{i=\text{all elbows}} y_i + \beta \sum_{i=\text{elbows} \parallel \text{plane}} y_i + \sum_{i=\text{all branches}} L_i y_i + 0.3 \sum_{i=\text{branches} \perp \text{plane}} L_i y_i\right]$$

$$YZ \quad I_z'' = \text{same as above.}$$

$$XY \quad I_y' = \alpha \sum x_i^2 + \beta \sum x_i^2 + \sum L_i x_i^2 + 0.3 \sum L_i x_i^2$$

Nomenclature

L = length of each piping branch, ft

x, y, z = coordinates of the centroid of each piping branch or elbow with respect to the original arbitrarily chosen X, Y, and Z axes, ft

$\vec{x}, \vec{y}, \bar{z}$ = coordinates of the centroid of piping system with respect to the original arbitrarily chosen X, Y, and Z axes, ft

I_x, I_y, I_z = moments of inertia of the system about its centroidal axes, ft^3 (magnified 12 times)

I_{xy}, I_{xz}, I_{yz} = products of inertia of the system about its centroidal axes, ft^3

I_1 = centroidal moment of inertia of branches parallel to Z axis, ft^3 (magnified 12 times)

I_2 = centroidal moment of inertia of branches parallel to Y axis, ft^3

I_3 = centroidal moment of inertia of branches parallel to X axis, ft^3

I_{ox}, I_{oy}, I_{oz} = sums of centroidal moments of inertia of elbows about their own respective neutral axes, ft^3

m = number of elbows in planes parallel to the axis of I_o

n = number of elbows in planes perpendicular to the axis of I_o

$I_{oxy}, I_{oxz}, I_{oyz}$ = sums of centroidal products of inertia of elbows parallel to the plane of inertia, ft^3

$\Delta x, \Delta y, \Delta z$ = total thermal expansion of the system in the X, Y, and Z directions respectively, in.

E_h = modulus of elasticity of the piping material at operating temperature or in the hot condition, psi

E_c = modulus of elasticity at installation temperature or in the cold condition, psi

I = moment of inertia of the cross-sectional metal area of the pipe, in^4.

S = section modulus of pipe, in^3.

D = outside diameter of pipe, in.

t = thickness of pipe wall, in.

r = mean radius of pipe, in.

T = temperature, F

e = thermal expansion in 100 ft of pipe due to a rise from installation temperature to operating temperature, in. per 100 ft

R = radius of curvature of elbow or quarter bend, ft

X, Y, Z = forces due to expansion, lb

M_{xy}, M_{xz}, M_{yz} = bending moments due to X, Y, and Z forces in XY, XZ, and YZ planes (one of these moments is actually a torque) ft-lb

X', Y', Z' = relative force values

$M'_{xy}, M'_{xz}, M'_{yz}$ = relative moment values in XY, XZ, and YZ planes

M'_d, M_d = relative and absolute values of combined bending moment at point d of the system, ft-lb

T'_d, T_d = relative and absolute values of torque at point d, ft-lb

h = characteristic factor

K = flexibility factor

L_a = actual length of elbow or quarter bend, or effective length of mitre bend, ft

i = stress intensification factor

α = transverse virtual length, ft

β = differential virtual length, ft

θ = one-half angle between adjacent mitre axes, degrees

c = cold spring factor

X_h, X_c = values of X force in hot and cold conditions, lb

s_b = maximum bending stress, psi

s_t = corresponding torsional stress, psi

s_a = allowable stress range, psi.

f = stress range reduction factor. ($f = 1$ for 7000 or less temperature cycles over expected life of piping.)

(1) to (27) = numerals each representing one row of figures

A, B, C = symbols each representing one numerical value

(a), (b), (c) = symbols each representing three values, A, B, and C

N = total number of elbows in a system

N_{xy} = number of elbows parallel to XY plane

$$-\bar{x}\left[\alpha\sum x_i+\beta\sum x_i+\sum L_i x_i+0.3\sum L_i x_i\right]$$

$$XZ \quad I_z' = \text{same as above.}$$

$$XZ \quad I_x'' = \alpha\sum z_i^2+\beta\sum z_i^2+\sum L_i z_i^2+0.3\sum L_i z_i^2$$
$$-\bar{z}\left[\alpha\sum z_i+\beta\sum z_i+\sum L_i z_i+0.3\sum L_i z_i\right]$$

$$YZ \quad I_y'' = \text{same as above.}$$

$$\left.\begin{array}{ll}\text{Entire System-} & I_x = I_x' + I_x'' + \dfrac{I_1}{12}+\dfrac{I_2}{12}\\[1ex] \text{Entire System-} & I_y = I_y' + I_y'' + \dfrac{I_1}{12}+\dfrac{I_3}{12}\\[1ex] \text{Entire System-} & I_z = I_z' + I_z'' + \dfrac{I_2}{12}+\dfrac{I_3}{12}\end{array}\right\} \text{------------------} [7]$$

$$XY \quad I_{xy} = \alpha\sum^{i=\text{all elbows}} x_i y_i + \beta\sum^{i=\text{elbows}\parallel\text{plane}} x_i y_i + \sum^{i=\text{all branches}} L_i x_i y_i + 0.3\sum^{i=\text{branches}\perp\text{plane}} L_i x_i y_i$$
$$-\bar{y}\left[\alpha\sum^{i=\text{all elbows}} x_i + \beta\sum^{i=\text{elbows}\parallel\text{plane}} x_i + \sum^{i=\text{all branches}} L_i x_i + 0.3\sum^{i=\text{branches}\perp\text{plane}} L_i x_i\right]$$

$$XZ \quad I_{xz} = \alpha\sum x_i z_i+\beta\sum x_i z_i+\sum L_i x_i z_i+0.3\sum L_i x_i z_i$$
$$-\bar{z}\left[\alpha\sum x_i+\beta\sum x_i+\sum L_i x_i+0.3\sum L_i x_i\right]$$

$$YZ \quad I_{yz} = \alpha\sum y_i z_i+\beta\sum y_i z_i+\sum L_i y_i z_i+0.3\sum L_i y_i z_i$$
$$-\bar{z}\left[\alpha\sum y_i+\beta\sum y_i+\sum L_i y_i+0.3\sum L_i y_i\right]$$

$$\text{where } \alpha = \left(\frac{K+1}{2}\right)L_a, \ \beta = \left(\frac{K-1}{2}\right)L_a$$

$$XY \quad \bar{y} = \left[\alpha\sum^{i=\text{all elbows}} y_i + \beta\sum^{i=\text{elbows}\parallel XY} y_i + \sum^{i=\text{all branches}} L_i y_i + 0.3\sum^{i=\text{branches}\perp XY} L_i y_i\right]$$
$$\div\left[\alpha N + \beta N_{xy} + \sum^{i=\text{all branches}} L_i + 0.3\sum^{i=\text{branches}\perp XY} L_i\right]$$

$$XY \quad \bar{x} = \left[\alpha\sum^{i=\text{all elbows}} x_i + \beta\sum^{i=\text{elbows}\parallel XY} x_i + \sum^{i=\text{all branches}} L_i x_i + 0.3\sum^{i=\text{branches}\perp XY} L_i x_i\right]$$
$$\div\left[\alpha N + \beta N_{xy} + \sum^{i=\text{all branches}} L_i + 0.3\sum^{i=\text{branches}\perp XY} L_i\right]$$

For clarity of presentation, the subscript $_i$ is defined only over the summation signs for I'_x and I_{xy} and are meant — but not repeated — for terms below them.

It is seen, from the above equations, that the numerical values for branches in torsion in each perpendicular plane (branches perpendicular to plane) is increased 30 percent to take into account their torsional effect on flexibility. Such increases in flexibility are tabulated in rows 2, 4, and 6 in Table 1 of Example 1.

When a piping system contains circular 90 deg elbows or quarter bends, each of these elbows contributes greater flexibility in bending than that of its true length to the system. This increased flexibility of elbow is accounted for by using a virtual length, KL_a, which is used in calculating line inertias in the plane of elbow. The flexibility factor, K, and the actual length of elbow, L_a, are defined below, with the condition that $K > 1$.

$$K = 1.65/h \ \ldots\ldots\ldots\ldots\ldots\ldots\ldots [8]$$

$$L_a = \pi R/2 \ \ldots\ldots\ldots\ldots\ldots\ldots\ldots [9]$$

Where the characteristic factor h is:

$$h = (12tR)/r^2 \ \ldots\ldots\ldots\ldots\ldots\ldots\ldots [10]$$

For example, for the elbow shown in Fig. 2, KL_a is its virtual length in calculations for line inertias in XY plane.

The elbow shown in Fig. 2 is completely in bending in XY plane and only partially so in XZ and YZ planes, i.e., the elbow is half in bending and half in torsion in the latter two planes. Since the flexibility factor for an elbow in torsion is unity, its virtual lengths in XZ and YZ planes are $[(K + 1)/2]L_a$. (Some experts advocate the use of factor 1.3, which is the same as the flexibility factor for a straight branch in torsion. Before the publication of the 1955 Code for Pressure Piping, piping engineers used (1) a smaller value of K at a low h value for in-plane bending of elbow, (2) factor of unity for transverse bending, and (3) factor of 1.3 for torsion. Hence, the virtual length was KL_a and transverse virtual length was $[(1 + 1.3)/2]\,L_a = 1.15L_a$.)

The equation for I'_x in XY for all elbows in the entire piping system is then:

$$I_x' = \left(\frac{K+1}{2}\right)L_a\sum^{i=\text{elbows}\parallel XZ,YZ} y_i^2 + KL_a\sum^{i=\text{elbows}\parallel XY} y_i^2 - \bar{y}\left[\left(\frac{K+1}{2}\right)L_a\sum^{i=\text{elbows}\parallel XZ,YZ} y_i\right.$$
$$\left. + KL_a\sum^{i=\text{elbows}\parallel XY} y_i\right] = \alpha\sum^{i=\text{all elbows}} y_i^2 + \beta\sum^{i=\text{elbows}\parallel XY} y_i^2 - \bar{y}\left[\alpha\sum^{i=\text{all elbows}} y_i + \beta\sum^{i=\text{elbows}\parallel XY} y_i\right]$$
$$\text{------------------} [11]$$

where

$$\alpha = [(K + 1)/2]\ L_a \ \ldots\ldots\ldots\ldots\ldots\ldots\ldots [12]$$

$$\beta = [(K - 1)/2]\ L_a \ \ldots\ldots\ldots\ldots\ldots\ldots\ldots [13]$$

Combining Equation 11 with I'_x for the straight branches in the system, we have the expression for I'_x in Equation 7. The sum of increases in flexibility for elbows in their own plane XY, i.e.,

$$\beta\sum^{i=\text{elbows}\parallel XY} y_i^2$$

is tabulated in row 8, and those in the other two planes are in rows 10 and 12. The numerical values in rows 2, 4, 6, 8, 10, and 12 result in the different final values for each plane, tabulated respectively in rows 16, 20, and 24. These final values are used to compute line inertias in rows 19, 23, and 27.

Note that the x, y, and z coordinates of the centroids of elbows are tabulated in Lx, Ly, and Lz columns in the elbows section of Table 1, i.e., $L = 1$ for all elbows.

The flexibility factor K, the characteristic factor h, and the effective length L_a of a mitre bend with a 45 deg centerline are:

$$K = 1.52/h^{5/6} = (1.52\ {}^3\sqrt{h^{1/2}})/h \ (\mathrm{K} > 1) \ \ldots\ldots [14]$$

$$h = (1 + \cot\theta)t/2r \ \ldots\ldots\ldots\ldots\ldots\ldots\ldots [15]$$

$$L_a = \pi R/2 \ \ldots\ldots\ldots\ldots\ldots\ldots\ldots [16]$$

where R for the mitre bend is defined as:

$$R = [r(1 \mp \cot\theta)]/2 \ \ldots\ldots\ldots\ldots\ldots\ldots\ldots [17]$$

The above formulas can be applied in Equation 7 and Table 1 for calculation of line inertias for a system containing mitre bends. ⧧

In the next article the author will discuss: calculation of moments and torques; determination of signs; hot and cold forces and moments; pipe stresses; allowable limits; centroidal moments and products of inertia of elbows and bends; and other factors in calculating pipe stress efficiently.

Air conditioning rockets summer demand for electricity . . .

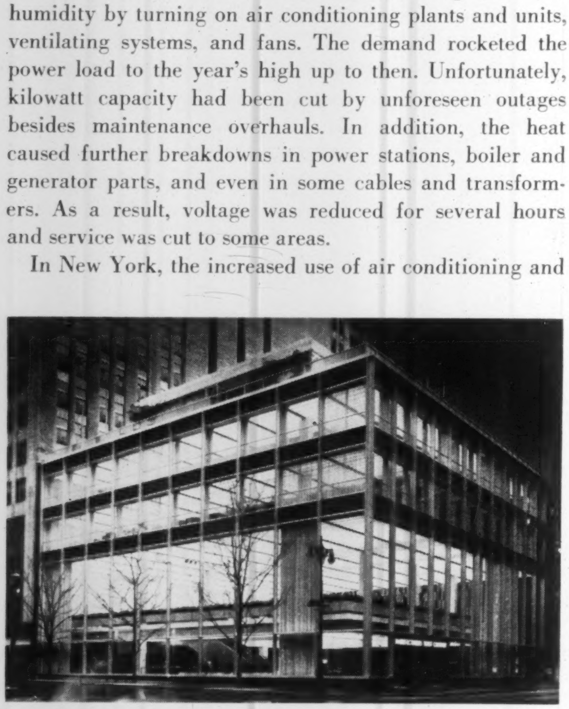
Power Shortage Hits Two Cities —Can It Happen Again

How will kilowatt capacity affect air conditioning installations? Can we be sure that "power emergencies" will not again unexpectedly interrupt operation of existing systems? If similar crises occur, will utilities curtail installations of new air conditioning equipment? What is being done to avert any future power crisis and provide continuous, adequate electrical service? Here's what HPAC found in a survey of several leading utility companies.

ONE DAY early this summer both New York and Chicago, in the midst of a heat wave, suffered from curtailed or low voltage electric service for air conditioning and other uses.

On the hottest day of the season up to that time, millions had sought relief from the sweltering heat and humidity by turning on air conditioning plants and units, ventilating systems, and fans. The demand rocketed the power load to the year's high up to then. Unfortunately, kilowatt capacity had been cut by unforeseen outages besides maintenance overhauls. In addition, the heat caused further breakdowns in power stations, boiler and generator parts, and even in some cables and transformers. As a result, voltage was reduced for several hours and service was cut to some areas.

In New York, the increased use of air conditioning and other electrical appliances during the hot spell was at first said to have caused the power crisis. But the company had been able to deliver considerably more power a few days before. Later, company spokesmen said this was because of a series of breakdowns in the generating system that might or might not have been caused by the heat.



NEW YORK: Air conditioning now represents 23 percent of Consolidated Edison's capacity. As elsewhere, new generating capacity is on the way. Shown is Manufacturers' Trust Co. branch

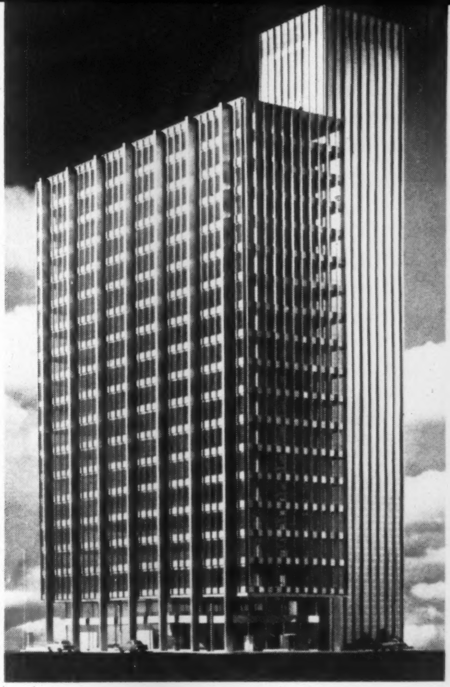
The question arises, can such a power shortage happen again, if not in the same cities, perhaps in others? Air conditioning installations are continuing to increase at a rapid rate all across the U. S. So great has been the added demand for electric power that many utility companies now report their annual peak loads in June rather than in January. Although there has been a general expansion of generating capacity — which is still in progress — will there be enough kilowatts next year, and each year, to meet the rising demand for air conditioning?

To find the answer to this crucial question, HPAC surveyed electric utilities in several leading cities. The results, while reassuring, indicate that the electric companies still face some tough problems. Chief are balancing summer and winter loads, improving maintenance schedules, and increasing the accuracy and length of weather forecasts.

Here's how different utilities plan to avert any further power shortage.

- *In New York*, the Consolidated Edison Co. has new generating capacity on the way, for which plant construction began several years ago. The utility estimates that 850,000 kw are required for air conditioning at any one time, up 17 percent from a year ago. Air conditioning now represents 23 percent of Consolidated Edison's capacity of 3.7 million kw. Tie-in lines for exchange of power with other companies raise the available capacity

Somewhere?



CHICAGO: New buildings, like the Inland Steel building, nearing completion, mean increasing electrical load in summer for air conditioning requirements

to over 4 million kw, a margin of 14 percent over the 3.4 million kw peak reached during the heat wave power crisis.

To compare with the 125,000 kw increase in air conditioning use in the last year, Consolidated Edison's building program is putting 350,000 additional kw into service in 1958. In 1959, another 350,000 kw will go into operation; in 1960, the Indian Point atomic power plant will bring in 275,000 kw more, and in 1961 the schedule will add 350,000 kw again. Company officials insist that the city is nowhere near any limit on the amount of air conditioning equipment that can be handled.

- *In Chicago,* the Commonwealth Edison Co. has a generating capacity of 4.17 million kw, including a new 275,000 kw unit now in operation. During the heat wave the 3.7 million kw demand approached the peak load last winter of 3.74 million kw.

Commonwealth Edison declares there are and will be no limitations on installation of new air conditioning systems in its service area. Likewise, there has been and will be no limitations on the use of existing air conditioning installations. New generating equipment to be completed in the next two years totals 1,155,000 kw.

The power outlook in the Commonwealth Edison area is for normal operation, "barring unexpected emergencies."

- *In Philadelphia,* it has not been necessary to impose a curtailment of power service because of the ever increasing air conditioning load. The Philadelphia Electric Co.'s continuing expansion and improvement program, which began immediately after World War II, will continue for some years to come, said the company. This program incorporates advance planning of adequate generation, transmission, and distribution capacity to carry all required loads and to provide an ample reserve. The growing air conditioning demand, of course, is an important factor receiving attention in all advance planning.

- *In the Washington, D. C., area,* the Potomac Electric Power Co. has been faced with rapidly increasing air conditioning loads for many years, according to Robert W. Wilson, vice president. Its large construction program, currently about $34 million annually, has been designed to meet these loads. Therefore, the company has not placed any limitation on power for such purposes and does not anticipate that such limitations will be necessary.

The peak load of 965,000 kw this summer, reached in June, was 11.8 percent higher than the 1956 peak, said Mr. Wilson.

A new 90,000 kw unit placed in operation at the Potomac river generating station in May brought the effective capability of the system to 1.1 million kw, including 35,000 kw of firm peak capacity available under an interchange agreement with another system.

To provide for future demands, a new generating station is under construction in Maryland. Initially it will house two 175,000 kw turbogenerator units, the first of which is scheduled to go into operation in 1959.

- *In the Baltimore area,* a peak sendout of 961,000 kw was reached in June due primarily to the high heat and humidity conditions and the fact that most of the local industries were in production, says G. B. Priester, air conditioning engineer, Baltimore Gas and Electric Co.

Continued growth in electric load is contemplated, and plans are being made to handle it, Mr. Priester reports. A second 125,000 kw steam electric generating unit will begin operation at the Herbert A. Wagner station in 1959. Authorized recently was another new unit — of

175,000 kw to be required in 1961 — which will be installed in a new generating station.

• *In Pittsburgh,* the Duquesne Light Co. reports it has not curtailed any electric power in recent years, and more specifically within the last two months because of power consumption in hot weather.

Anticipating the construction of new office buildings in downtown Pittsburgh, plus the installation of air conditioning in older buildings, the company has reinforced its power supply in the downtown district by the construction of a major substation and additional cables in the downtown section supplying areas not served by the new substation.

"We have an adequate power supply for the present and also within the foreseeable future, and we do not contemplate any shortages," said a spokesman.

• *In Cleveland,* The Cleveland Electric Illuminating Co. reports that Northeast Ohio has an ample supply of electric power on hand and available to meet all demands. Said a spokesman, "the company was planning several years ago for the electrical needs of today. And today it is planning for the needs of five, even 10 years hence."

Two giant turbogenerators are currently being added to the Illuminating system. One is a 240,000 kw unit due for completion at the Ashtabula generating plant next year. The other is a 250,000 kw unit for the Avon power

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300 Ton Heat Pump System Serves New Office Building

THE NEW $2½ million administration office building of the Tacoma, Wash., city light department has a modern heat pump system that provides heating and cooling at less cost per year than a system that provides heating alone in another building of comparable size owned by the same utility, according to The Trane Co.

The all concrete structure is 100 × 300 ft and at present consists of four and one-half stories. As flexibility was of paramount importance there are few permanent partitions. Throughout these areas it was necessary to plan that any future subdivision of space would contain all facilities, including air conditioning.

The building heat losses and gains throughout the expected temperature range are approximately equal at 37 F outside air temperature. This is just a little below the average daytime outside air temperature over the entire year, and also represents a typical condition over a very large number of daytime hours during the year.

Under these conditions, the heat pump system makes possible the recovery of heat gains in internal portions of the building. When this is used in balancing the heat loss around the perimeter of the building, very substantial economies are realized over alternate systems which would involve the air conditioning of internal zones, while some fuel is needed to heat exterior zones.

Another factor in the selection of a heat pump system was the availability of electrical power at reasonable cost. And another was good quality water supplies in two wells available at the site.

The air cycle in the air conditioning system includes an 81 in. double width, double inlet, backwardly inclined fan in a roof equipment room. The fan circulates approximately 150,000 cfm of air through the building. On each floor it passes through coils in a coil and damper room where it is either heated, cooled, or mixed with bypass air. From there it is discharged through a system of branch ducts and ceiling air diffusers to the various occupied zones. The air returns through ceiling and window sill grilles to a central air shaft and then back to the main fan. A minimum amount of outdoor air — approximately 25,000 cfm — is introduced continuously.

Two 150 ton hermetic centrifugal compressors are in the main equipment room on the roof. One of the circulating pumps picks up water returning from the heating coils in each of the coil and damper rooms throughout the building and delivers it to the condensers. From here it is circulated back to the supply side of the heating coils during the periods of heavy heating load.

During the periods of heavy heat gain a second circulating pump picks up water returning from the cooling coils and delivers it to the evaporators, from where it goes back to the cooling coils.

Through a system of automatic controls, well water from the supply well is admitted to the evaporator or chilled water circuit and delivered to the drain well, to balance the excess heating load during heavy heating periods. Conversely, the well water may be admitted to the hot water circuit and passed through the condensers and admitted to the drain well during periods of high heat gain. During the many intermediate periods when total heat gains are approximately equal to the total heat losses, very little well water is used and the compressors operate as balancing units for the two sides of the system.

plant, scheduled for completion in 1959. These additions will increase the capacity to 2.3 million kw.

- *In Indianapolis*, the Indianapolis Power & Light Co. says it has not been necessary to curtail or place limitations on power consumption for any purpose, air conditioning or otherwise, in its area. The company has been able to expand its system sufficiently in advance of load increases to handle all new loads. Under the present expansion program, the company plans to continue to be able to meet all new loads without the necessity of limitation or curtailment of power supply.

For air conditioning loads, the company does have certain practices which must be followed as to starting requirements and supply voltage, depending on the size and nature of the air conditioning load, but these do not relate to the basic ability to serve all new air conditioning loads.

The company is presently engaged in an extensive and aggressive promotion of the benefits of electric space heating to create a load which it is expected will complement the seasonal characteristics of air conditioning. With the development of the heating market, said an official, the company's ability to supply the summer cooling load will be assured, and at an economical level of service charged.

- *In Milwaukee*, the Wisconsin Electric Power Co. has had no problem to date, nor has there been any discussion in the organization contemplating such problems.

At present, the company is materially increasing its capacity. Therefore, it does not contemplate any curtailment of air conditioning load or any other type of load. Like most other utilities, it is interested in increasing loads.

- *In St. Louis*, the Union Electric Co. has experienced no load curtailment this summer in connection with air conditioning.

In the summer of 1954, as a result of voltage difficulties, the company began an accelerated program of strengthening its distribution system until now it can cope with the sudden peaks that occur in extremely hot weather.

On the same date when there was power curtailment in New York and low voltage in Chicago, Union Electric experienced an all time peak load of 1.5 million kw, and had no curtailment or voltage drop, or transformer burn outs.

Since the 1954 experience, the company has replaced more than 14,000 transformers and has increased the size in about 500 miles of distribution and subtransmission lines. It has also installed capacitors and built a number of new substations.

- *In the Kansas City*, Mo. area, according to Warren L. Porter, vice president of the Kansas City Power & Light Co., "We experienced this unprecedented air conditioning load about three years earlier than the eastern companies.

"In the summer of 1954 we had a severe heat wave which caused our summer loads to go far beyond anything we had previously expected," Mr. Porter said. "Fortunately, it was not necessary for us to require curtailment of power and no shortages occurred in our system except isolated and temporary cases, which we cured by reinforcement of the distribution system.

"This experience caused us to accelerate our plans for conversion to 13,000 volt distribution. This program has been carried to a point which we anticipate will take care of immediate needs and will be continued in advance of estimated requirements."

- *In the Houston area*, electric utilities summer peak loads have exceeded those of winter for a number of years, due primarily to high concentration of air conditioning equipment in commercial and industrial establishments as well as in homes. Houston Lighting & Power Co. for example, serves some 500,000 tons of connected load in air conditioning equipment and so invariably experiences its peak loads in summer.

Throughout the postwar period, the Houston Lighting & Power Co. has invested more than $250 million in expansion of the company's generating capacity from 1/4 million kw in 1945 to more than 1.4 kw at present, the company said. Additional reserve capacity is afforded by interconnection with neighboring companies.

As for the future, the company has placed firm orders and has under construction for installation during the four year period from 1958 through 1961 another 1½ million kw of generating capacity, its reports. This project will cost $300 million within that period.

- *In Denver*, the Public Service Co. of Colorado reports that it has not had to curtail the installation of electrical equipment anywhere. Its present capacity, combined with additional capacity now under construction and planned for the future, appears to be abundantly adequate to meet air conditioning as well as all other requirements, according to R. T. Person, vice president.

Plants now under construction and scheduled to go into operation this year will add about 20 percent to the present generating capacity. In addition, another 100,000 kw unit has been ordered and scheduled to go into operation in the fall of 1959.

- *In Detroit*, The Detroit Edison Co. reports no crisis during the hot spell. According to Eldred H. Scott, vice president and controller, "We have not been compelled to place limitations on power consumption in hot weather, and we have no present indication that such measures will be necessary in the future, either on existing air conditioning systems or on the installation of new air conditioning systems."

In contrast to many other systems, Detroit Edison's peak demand still occurs in the winter, generally in December. Says Mr. Scott, "In all studies we have conducted, we can find no indication that this situation will change in the foreseeable future. Thus, our future capacity additions are based on winter requirements.

"As our capacity is adequate to take care of this winter peak demand and we have a comfortable reserve margin, we expect to encounter no shortage during the summer months, even with equipment down for scheduled maintenance," he said. ≠

NEW LABORATORY will be dedicated this month during the second engineering conference on steam and water heating and summer cooling at the University of Illinois

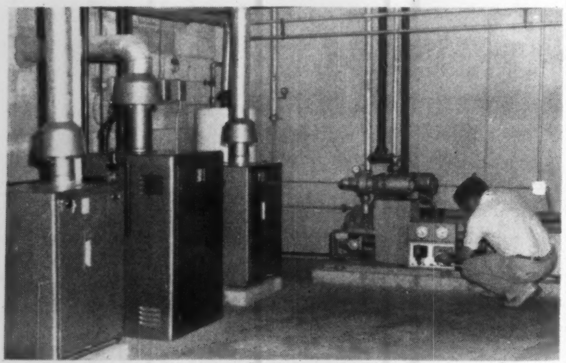
CONTROL ROOM, where temperatures and heat inputs are measured without entering test room, permits changeover from hot water to steam in less than 1 hr

Dedicate New IBR Lab

. . . to provide facilities for unbiased of ratings of all radiation

THE NEW LABORATORY of the Institute of Boiler and Radiator Manufacturers at Urbana, Ill., for check testing ratings of all radiation with IBR ratings will be dedicated this month.

The laboratory has been built by the IBR to provide facilities for unbiased check testing of ratings of all radiation bearing the IBR emblem. Any manufacturer of baseboards, convectors, or finned tube radiation may rate his products in accordance with IBR testing and rating codes, whether a member of IBR or not. But questions about these ratings have come up from time to time. Therefore, it has been decided that a check test of the products to determine their rating in an industry sponsored laboratory would be beneficial to assure uniformity of all IBR rated products.



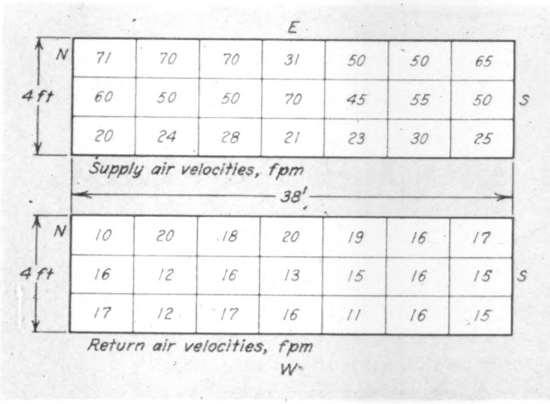
TWO GAS FIRED STEAM BOILERS supply steam for testing radiation in lab. Hot water boiler, center, heats lab. Technician is adjusting controls on 5 ton water chiller

If the output of the radiation upon checking at the laboratory is 3 or more percent below the existing rating, the manufacturer will be notified and asked to re-rate it, or submit it for a second check test. If the second check test does not reveal a closer correlation between the manufacturer's rating to permit a lower tolerance than 3 percent, the manufacturer will face the loss of the IBR emblem on his product.

This procedure will assure the accuracy of IBR ratings and offers the users of this equipment an additional guarantee, stated Robert E. Ferry, general manager of the IBR, when the plans were announced for construction of the new laboratory.

The new laboratory has two standard test booths in a large room, 38 × 24 × 16 ft high. These test booths have been built and are equipped in accordance with the IBR Testing and Rating Code. The booths are 12 × 15 × 8 ft high, and each booth has one open side. The rating conditions maintained in the test booths and in the room consist of an air temperature of 65 F and virtually no air movement. These are standard conditions which are specified as the basis for all rating tests in the Code.

In order to achieve these standard conditions in the winter, the laboratory is heated by means of finned


E
N
4 ft
S
38'
N
4 ft
S
W

71	70	70	31	50	50	65
60	50	50	70	45	55	50
20	24	28	21	23	30	25

Supply air velocities, fpm

10	20	18	20	19	16	17
16	12	16	13	15	16	15
17	12	17	16	11	16	15

Return air velocities, fpm

RECORD OF AIR VELOCITIES measured 6 in. below supply outlet and return air intake in test room shows uniform air distribution pattern. Air flow rate is 2000 cfm

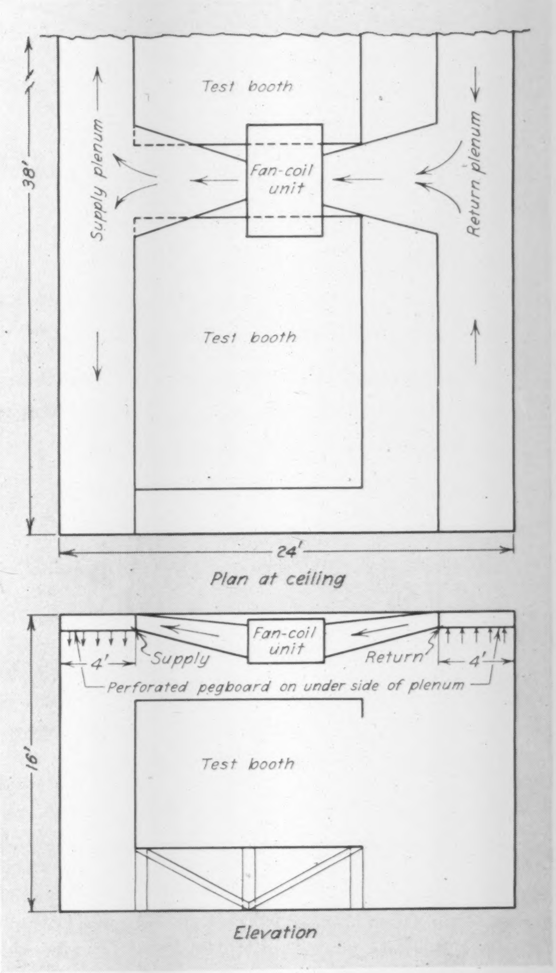
check testing bearing the IBR emblem

tube radiation installed on the exposed walls. Hot water is supplied to this radiation from a gas fired boiler which also supplies the heating needs of the other parts of the laboratory.

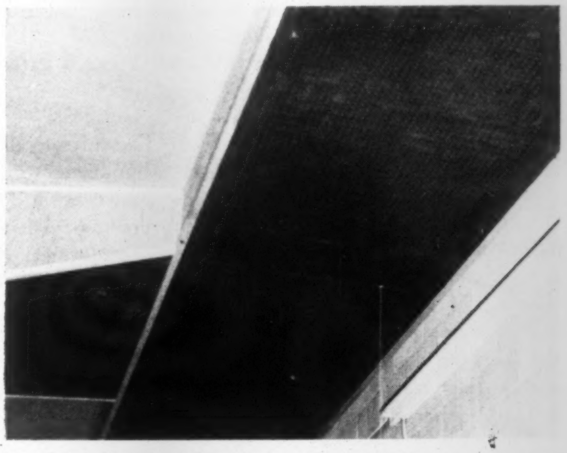
The room is air conditioned by a fan-coil unit suspended from the ceiling. Chilled water is piped to this unit from a 5 ton water chiller in the shop area. A unique air distribution system was devised for this room which permits the 2000 cfm to be admitted into the room without causing perceptible air movement. The supply outlet is a perforated pegboard mounted on the bottom of an extended plenum 38 ft long and 4 ft wide. The plenum is the full length of the room and is adjacent to the 16 ft ceiling. A similar arrangement for returning the air to the fan-coil unit is installed on the opposite side of the room. Results of air velocity measurements made 6 in. below both the outlet and intake are given in the illustration at the top of this page. It will be noted that both supply and return air velocities are very uniform. The air movement in the room is well below an average of 30 fpm.

The laboratory offices, library, and the control room are heated by baseboard radiation connected to the hot water boiler in the shop which heats the test room. A separate fan-coil unit and water chiller serves these areas for meeting the air conditioning needs.

The laboratory cost about $75,000, including the purchase of an acre of land. It is to be operated on a self-supporting basis. ⧧

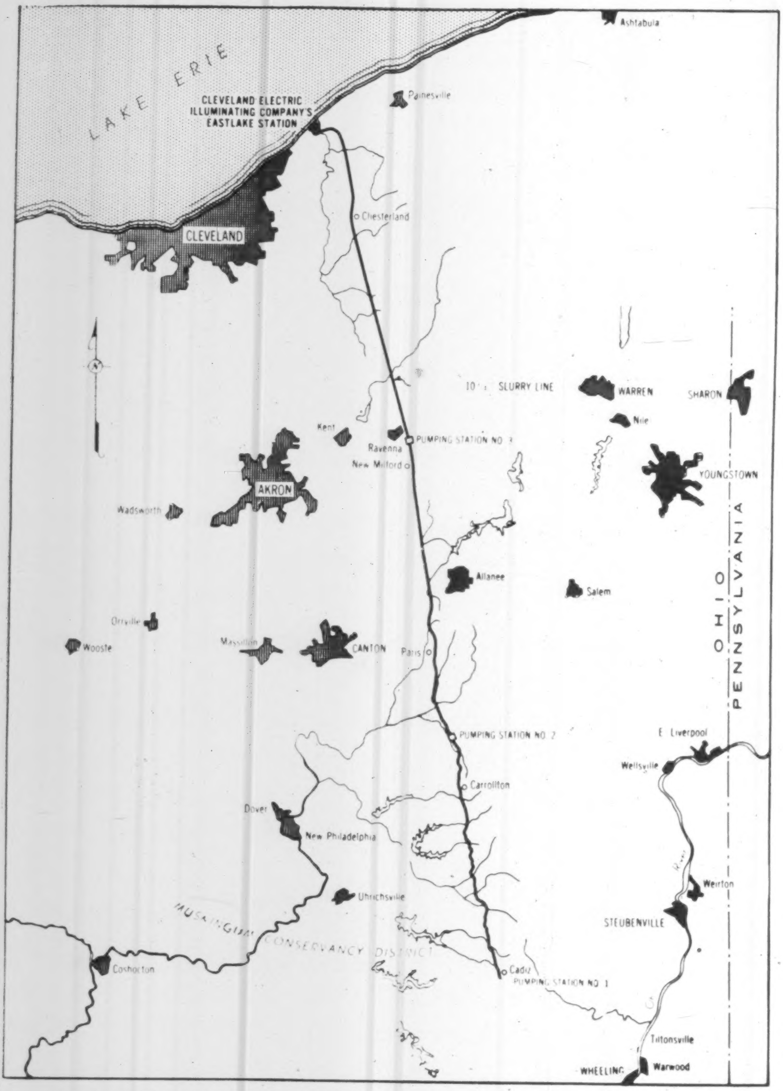


TEST ROOM, shown in plan and elevation, has fan-coil unit suspended from center of ceiling. Air distribution system recirculates 2000 cfm of air continuously



PERFORATED PEGBOARD on bottom of supply and return plenums, 4 ft wide × 38 ft long, permits low entrance and exit air velocities

Pipe Line


LAKE ERIE
CLEVELAND ELECTRIC ILLUMINATING COMPANY'S EASTLAKE STATION
Ashtabula
Painesville
Chesterland
CLEVELAND
10' SLURRY LINE
WARREN
SHARON
Nile
Kent
Ravenna
PUMPING STATION NO. 3
New Milford
YOUNGSTOWN
AKRON
Wadsworth
Allanee
Salem
OHIO
PENNSYLVANIA
Orrville
Wooste
Massillon
CANTON
Paris
PUMPING STATION NO. 2
E. Liverpool
Wellsville
Carrollton
Dover
New Philadelphia
River
Weirton
Uhrichsville
STEUBENVILLE
MUSKINGUM CONSERVANCY DISTRICT
Coshocton
Cadiz
PUMPING STATION NO. 1
Tiltonsville
WHEELING
Warwood

PIPE LINE LAYOUT includes three pumping stations and several coal storage ponds, between preparation plant near Cadiz and Eastlake utility station terminal. Maximum slope is 10 deg

BY CLARENCE A. DAUBER
Director of Engineering
Cleveland Electric Illuminating Co.

THE FIRST commercial conveying of coal by a long distance pipe line marks 1957 as a historical milestone.

The project started in 1949, when the need for cheaper means of transporting coal was realized.

The Pittsburgh Consolidation Coal Co. already had been operating equipment which could be embodied in a modern coal cleaning plant. The practice in many cases is to make a coal-water slurry, dewater it, and then dry it. If the slurry preparation were kept at the source and the dewatering and drying shifted to the point of coal use, the additional equipment needed would be a longer pipe line in between for conveying the slurry.

Construction of the 108 mile coal pipe line was preceded by two pilot plants in which the method was proved feasible and economical.

Pipe Line Has Three Sections

The pipe line has three main parts:

1) The preparation plant.

2) The pipe line, including its pumping stations.

3) The dewatering and drying terminal.

The preparation and coal cleaning plant is at Georgetown, Ohio, near large reserves of coal.

In addition to the initial pumping station at Georgetown, there are two stations enroute. The second is at Carrolton, approximately 30 miles north of Georgetown, and the third, at Atwater about 30 miles north of Carrolton.

The dewatering and drying plant is near the Eastlake plant of The Cleveland Electric Illuminating Co. With a capacity of 660,000 kw, this plant consumes 1½ million tons of coal a year.

The main source of coal at the Georgetown cleaning plant is coal fines from the mines. About 80 percent of the coal is pumped from this origin. The clean slurry is pumped to the preparation plant before entering the pipe line.

To provide the large constant quantity of water required, the ca-

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This article was adapted from a paper presented before the 19th annual meeting of the American Power Conference.

Transports Coal from Pit to Plant

The world's first commercial long distance coal pipe line — of 10¾ in. OD steel pipe with all welded joints — is buried below the frost line for 108 miles in eastern Ohio. Here's how problems of erosion, corrosion, maintenance of continuous flow, provision for emergency repairs, and others were solved for this $12½ million project. Commercial operations are scheduled to begin this month.

pacity of an existing lake was increased by raising the dam height. The lake now contains six months' supply.

Crush Coal, Mix with Water

The principal parts of the preparation plant are crushers, screens, storage tanks, drag tank, and the slurry mixing equipment.

Three storage ponds at the preparation plant permit continuous operation of the line when the cleaning plant is out of service. The pipe line operates on a 24 hour, seven-days-a-week basis, whereas the Georgetown cleaning plant is on a two or three shift operation, five days a week. As a result, the preparation plant was designed for an output of 300 tons per hr, whereas the pipe line requires only 150 tons per hr to be fed into it.

Pumps Keep Slurry Moving

The slurry from the mixer is pumped to the suctions of the pumps in the intial pumping station. There are three pump units at each of the three locations. Each unit consists of a reciprocating pump driven by a 450 hp squirrel cage motor connected through hydraulic couplings and a speed reducer. Two of these pumps are required to supply the total requirements of the pipe line. Each pumps approximately 530 gpm of slurry which has 306 gal of water in it, the balance being coal. These pumps are capable of discharging the slurry at 1000 psig pressure. The discharge from each pump goes to a single surge tank which feeds directly into the pipe line.

The two booster pumping stations enroute are typical of the Georgetown pumping plant except for the reservoirs at Carrolton and Atwater. The latter have two each, one for storing an emergency supply of water and the other for emergency dumping of slurry. The water is pumped from wells at each site.

The purpose of the hydraulic coupling is to insure automatic compensation for pump wear. The third pump is a standby which will be used when the volumetric efficiency of any one drops below 80 percent. The pumps were primarily built for handling solids. Provisions have also been made to minimize stoppage of flow. Controls automatically bypass any of the booster stations having a power failure, the preceding station being adjusted to carry the additional burden.

Previous Pipe Lines Were Shorter

This is not the first time that a pipe line has been used to transport solids. Back in 1889, W. C. Andrews, founder of New York Steam Corp., built a pilot installation which in many ways was the duplicate of the Ohio pipe line. Although it operated for a time satisfactorily, it never resulted in an actual commercial installation.

In France a short pipe line, about seven miles long, conveys coal from a coal cleaning plant to a steam plant. Many of the components in this line are similar to the one from Georgetown to Eastlake. The main variation is that the flow depends primarily upon gravity.

For a long time many companies have been successfully and economically pumping ashes from the bottoms of boilers to points of disposal.

Other experimental work has also been done in pumping a coal and oil slurry.

SEALED PIPE is tested with a high voltage coil to find unprotected areas, the last operation prior to burying the pipe in a 4 ft trench. Such precautions are expected to pay dividends in additional life to pipe line

There is a single pipe leading from each of the pumping plants. It is a 10¾ in. OD steel pipe with all welded joints. The wall thickness depends upon the location, as the pressure becomes lower as it proceeds through the pipe line. The pipe wall thickness does not exceed 0.7 in. The entire pipe line is buried below the frost line, about 4 to 5 ft deep.

Since the pipe line goes over hilly terrain, the maximum inclination is 10 deg.

The velocity in the 108 mile line is approximately 4.5 fps. The time lapse from the point of introduction to delivery is over 30 hr. If the pumps fail and the velocity of the slurry drops to zero, no harm is done. Even though the coal will drop to the bottom of the pipe, it will not compact. The increase in the water velocity, caused by partial blocking of pipe by the coal, when flow is restarted is sufficient to turn the coal and water into a slurry.

Erosion Less Than Expected

"Won't the erosion be excessive and cause rapid wear?" True, some erosion will take place; however, it will not be to the degree usually expected. There are several reasons for this.

One is that the coal will be much cleaner than that normally handled; it is the ash and silt that is excessively erosive. Also, coal itself has greasy qualities. Another fact is that the erosion decreases after the slurry is pumped a short distance, because the sharp corners are worn off, causing the particles to become round.

Nevertheless, 20 years of wear material were added to the pipe wall thickness when the pipe was selected to provide for pressure and safety.

Caustic Minimizes Corrosion

A problem greater than erosion is corrosion. Corrosion can occur either on the exterior or the interior of the pipe. Exterior corrosion is normal on any pipe line. This pipe line is coated with an enamel reinforced with glass cloth over the exterior surface, which should minimize corrosion. Also, the pipe line will be given cathodic protection, after it has operated for a period of time.

The interior corrosion could be initiated by two ingredients in the slurry:

1) The acid solution formed by water leaching sulfur compounds from coal.

2) The oxygen dissolved in the water.

In order to minimize interior corrosion, caustic is added to neutralize the slurry. The goal is to have a minimum pH of 6½. The action of oxygen is arrested by introducing an inhibitor into the slurry. In addition, nitrogen is used in the surge tank heads. The treatment is added at the three pumping points because better control will be accomplished by doing it this way rather than at one source.

How Slurry Is Dried

In the dewatering and drying plant, the slurry is thickened by the removal of water. The resulting coal cake is then dried in drying columns, from which the coal is discharged to a belt which carries it to a 1200 ton surge bin.

At eight hour intervals, the coal from the surge bin is fed to the 1200 ton per conveyor system, which takes the coal to the plant coal storage bunkers.

Line Moves 1¼ Million Tons

The coal pipe line will furnish 1¼ million tons per year, or about 80 percent of the coal burned in the plant.

Project Cost $12½ Million

The total cost of the project was approximately $12½ million. The entire project is owned by Pittsburgh Consolidation Coal Co. Operation of the dewatering and drying facilities is the responsibility of The Cleveland Electric Illuminating Co.

Since all the equipment is substantially oversize, the system will be able to transport a greater amount when desired.

The author wishes to express his appreciation for the assistance given by Victor Hanson, chief mechanical engineer of Pittsburgh Consolidation Coal Co., and Gordon Walker, senior project engineer of The Cleveland Electric Illuminating Co. +

Steam Pipe Line Construction Costs Reduced, NDHA Reports

Other developments in district heating discussed at the 48th annual meeting of the National District Heating Association include:

- ***corrosion testing in condensate systems***
- ***atomic energy for space heating***
- ***the need for a creative sales approach***

BY JOHN F. COLLINS, JR.
Secretary-Treasurer
National District Heating Association

WAYS to reduce construction costs of steam pipe lines highlighted the steam distribution aspects of the program at the recent four day annual meeting of the National District Heating Association at Hot Springs, Va. A previous report on the meeting was in the August HPAC.

Steam Line Construction Methods Progress

The distribution committee, whose chairman is Jerome J. Collins, assistant general superintendent of steam distribution of the Consolidated Edison Co. of New York, Inc., presented three papers and a panel discussion.

The first paper was a detailed cost analysis of the Delray steam line recently installed by The Detroit Edison Co. The paper was prepared by Messrs. Hafeli and Yelton, engineers of the company. The line, partly 12 in. and partly 10 in., is 6510 ft long, has 25 manholes and cost a total of $665,000. Trenching, envelope, manholes, extra excavation, bracing, and sheeting cost $76.25 per ft of main. Piping material and labor cost $17.41 per ft of main. Insulation material and labor cost $6.86 per foot of main.

John Bogdanowski, superintendent of the methods division of Consolidated Edison, described the progress being made in boring horizontally through the earth for steam lines, gas lines, and electric conduit. He said that with their present equipment they can bore through earth soils at rates of from 30 to 40 ft per hr and through rock formations at rates of from 12 in. to 4 ft per hr, hitting the target with a minimum of deviation from line and grade. The method permits the installation of underground structures below the present congested levels where open trench and tunneling methods would be economically impossible and with a minimum disruption of traffic.

Mr. Bogdanowski said that their contractors' bores range from 1 in. to 30 in. in diameter and from 30 to 250 ft in length. Pipes are rotated and propelled through the earth by a drilling machine and a system of hydraulic jacks. There are several machines each designed for a particular kind of boring.

The Detroit Edison Co. has been testing the vertical and lineal movement of a 20 in. steam main when steam is introduced slowly, gradually, and rapidly to the cold line, at first bare and later insulated. The utility was especially interested in the possible effect of deflection on solid pour underground steam mains.

The results of the tests were reported by Carl W. Signor, supervising engineer of customers' steam service and James W. Wemyss, engineering assistant.

It has been known that as the steam travels along the top of the pipe when it is introduced, that part heats up more rapidly and a bowing upward occurs. Much more deflection took place with bare than with insulated pipe. Rapid "turn on" produced the least deflection at a majority of the stations. No harmful effect on the solid pour construction was indicated.

The panel of four well qualified engineers discussed materials and methods currently being used in their respective organizations to decrease the cost of steam line construction. It is especially interesting that three of four discussed solid pour concrete.

John C. Haroldson, vice president of the Duluth Steam Corp., pointed out that a 12 in. solid pour line 3750 ft long carrying steam at 250 psig has been in use for 37 years. He said that in 1949 in Duluth they installed six blocks of 8 in. line, the cost of which if installed today would be $36 per ft. Under favorable conditions in 1954 the Rice Lake Steam Corp. built 6440 ft of 4 in. and 5 in. line at a cost of only $11.23 per ft.

The New York representative, Charles E. Pray, described their new prefabricated steel shell conduit. He said it is easier to handle steel shells than those of concrete. The steel construction is less bulky to pass through congested subsurface areas and it is watertight. He said that when they have had more experience they believe they can build better lines for less cost.

Conditions in Pittsburgh are different from those in most other areas having district steam service in that condensate is returned to the plants from the compact distribution system. Foster L. Stephens, steam heating engineer of the Allegheny County Steam Heating Co., de-

PIPE LINE MOVEMENT — vertical and horizontal — is recorded automatically by device shown here

scribed the evolution of his company's two pipe concrete conduit from one with much air space surrounding the lines and roller pipe supports to a solid pour construction. One factor was the city's expensive specification that backfilling consist of eight parts of granulated slag and one part of cement.

Edmund D. Bossone, engineer of the Philadelphia Electric Co., commented that he felt the greatest saving can be accomplished by prefabricating conduit and using more mechanized equipment. He said it is difficult to use such facilities in downtown Philadelphia due to congestion above and below the street surface. Recently a line constructed in the suburbs using a clamshell bucket cost 30 percent less than a similar line built downtown.

How Much Spare Boiler Capacity Needed?

The steam station engineering committee, headed by Edwin C. Cawrse, superintendent of the steam department of The Cleveland Electric Illuminating Co., had as the first of several speakers Robert A. Lorenzini, manager of the service department of the Foster-Wheeler Corp. Mr. Lorenzini's topic was dual circulation boilers. He said that this design permits the maintenance of low concentrations of salts and mineral constituents in the high heat absorbing portions of the boiler where the bulk of the steam is generated.

Since it is generally possible to condense all or most of the steam generated in the high concentration section, the carryover of salts from this section in mechanically entrained or vaporized form will not contribute significantly to the carryover from the boiler, and the salts in the steam leaving the boiler will actually be in equilibrium with those in the low concentration section. It is possible to use less expensive feedwater treating methods.

The second paper on the steam station program was by S. F. Mumford, chief engineer, hot water boiler division, Combustion Engineering, Inc., and was on the subject of the use of controlled circulation boilers for high temperature hot water heating systems. Mr. Mumford described the boilers and said that whether to use high temperature hot water or steam for heating or process work depends on system requirements. He felt that for large heating systems and certain process applications, high temperature hot water frequently has advantages over steam. Boilers are available designed for this service.

George M. Johnson, superintendent of steam stations of the Rochester, N.Y., Gas and Electric Corp., reported on his investigation of spare boiler capacity of the heating utilities. He said that the replies seemed to indicate that a reserve equal to the capacity of the largest unit would be required.

The results of a survey on the adequacy of the present, or third, edition of the District Heating handbook was reported by Charles E. Richards, supervising engineer, technical engineering division, The Cleveland Electric Illuminating Co. The survey was not made with the idea of publishing a new edition but to determine some facts about the present one. Mr. Richards and his committee found that the chapters on steam distribution and metering are those referred to most often and that these are the most important ones. They suggested that more data is needed on new insulating materials, high pressure water heating, air conditioning, and the heating of ultramodern buildings.

Campus Utility Increases Steam Capacity

The heating system of the University of Virginia at Charlottesville and its operation were described by E. M. Mittendorff, director of utilities at the university, as a part of the campus heating committee program headed by George K. Saurwein, who before his retirement was with Negea Services.

Mr. Mittendorff said they were adding a third boiler of 72,000 lb per hr capacity to their modern system. The other two boilers each have a capacity of 50,000 lb per hr. He described the equipment and controls for handling coal, water, steam, and ashes.

Two hot water storage heaters, each with a heating capacity of 3500 gal per hr from 40 F to 180 F and a storage capacity of 1700 gal, using steam at zero psig, supply the domestic hot water requirements.

The total steam demand for space heating with hot water radiation, steam radiation in the gymnasium, and steam coils in the air conditioning systems, and for cooking, heating the swimming pool water, domestic water heating, and laboratory use is 83,607 lb per hr.

Mr. Mittendorff said the total cost per M lb of steam was $1.06 in the last season.

Sleeves Reinforce 25 Year Steam Line Welds

J. C. Segeler, chief engineer of the University of Chicago, reported on reinforcing 25 year old steam line welds. In 1929 the university built a steam tunnel 8 ft wide by 7 ft high and a mile long. It contains two 12 in. extra heavy steam mains which operate at 150 to 180 psig. The flanges used were designed to be welded around their circumferences in place of having gaskets between them. They were gas welded by men who did not have to have the qualifications of today's welders.

In 1942 two welds failed at 50 psig. Examination of the welds and test plugs showed all to be defective.

It was decided to install welded reinforcing sleeves over all welds using the electric arc method and "qualified" welders. A welded sleeve consists of two semi-cylindrical sections divided lengthwise and with a centrally located circumferential recess to fit over the underlying pipe weld. The sleeve sections are welded together over the pipe weld and then the sleeve ends are welded to the pipe. Open end pipe nipples 1/8 in. in diam serve as telltales and prevent pressure building up between the pipe and the sleeve.

Asks Improvement in Meter Design

One of the most important needs in the district heating field is improvement in metering. Victor J. Bliemeister of The Detroit Edison Co. is chairman of the metering committee of NDHA, which this year had two papers to report on steam metering.

In the first of these, James W. Althouse, Jr., assistant superintendent, meter division, Philadelphia Electric Co., said that an attempt had been made to procure a meter for use in conjunction with the linear primary element that would make maximum use of the linear qualities of the device as a flow transducer.

He said that indicated improvements in the design of the primary element itself should be made, continued efforts should be put forth to develop a suitable secondary metering element, and finally, comparison should be made of pulsating flow performance with an equivalent orifice operation.

In the second paper William G. Gillim, assistant superintendent, customer steam service operations, Consolidated Edison Co. of New York, Inc., described a proposed development of a mass flowmeter of the inertial type, suitable for steam flow metering.

Three experimental models are to be built having a capacity of about 2500 lb per hr of dry saturated steam at 140 psig. They are to be capable of withstanding continuous operation at a temperature of 500 F and are to have an error tolerance of better than ± 2 percent of point from 5 percent of rated flow to full capacity.

Mr. Gillim was optimistic that the flow range can be greatly extended in the future.

Can't Predict Plant Life from Corrosion Tests

Experience with corrosion testing in condensate systems was reported on by E. A. Yorkgitis, development engineer of the Hagan Chemicals & Controls, Inc.

Mr. Yorkgitis discussed the value of corrosion testing in condensate systems and related some experiences with a corrosion test unit. He gave corrosion test data for different levels of corrosive oxygen and carbon dioxide. Specimens installed in the lines demonstrate the corrosion reduction obtained with inhibitors. He said that testing should not be relied on to predict exactly the life of a plant.

Develop Atomic Heating Applications Now

Atomic energy for space heating was the subject of a paper prepared by Dr. A. Louis Medin, head of the nuclear chemical technology of Alco Products, Inc. and Messrs Louis H. Heider and Richard J. Clark, nuclear chemical engineers with the same organization, builder and operator of a small reactor.

Dr. Medin said that they cannot predict when atomic energy will become feasible for overall space heating but there are some immediate applications. Big problems are the cost of the nuclear plants and radioactivity, the former making nuclear space heating uneconomical now except where conventional fuels are not available and where transportation of such fuels is extremely expensive; for example, at some places where our armed forces now are located. The availability of fossil fuels is decreasing while power demands are rising rapidly.

A second paper on the subject of atomic energy was presented on the program by Albert I. Brayman, consulting engineer of Boston.

Mr. Brayman voiced the opinion that the heating industry in the U.S. cannot any longer afford to avoid the challenge of the atom, but should place its resources in the field for development applications.

Give Tips on Heating, Air Conditioning

The commercial relations committee headed by Carl W. Signor, supervising engineer, customers' steam service of The Detroit Edison Co., included three papers. In the first of these, Lewis Smith of Dunham-Bush, Inc., spoke on the benefits of using vacuum pumps and at the same time pointed out how faulty installations may prevent the owner from receiving the full value of these benefits. [An abstract of Mr. Smith's paper is published as the Data Sheet in this issue of HPAC.]

The subject of the second paper, by Irving G. Brennan, manager of air conditioning and unit heater sales of Warren Webster & Co., was "In-Wall Air Conditioners."

Mr. Brennan said that by using this new equipment, which heats, cools, filters, and dehumidifies existing office buildings, hotels, and apartment buildings can have air conditioning employing either low pressure steam or circulated water, the modernization being accomplished room by room. Each unit has integral controls.

In the third paper Chairman Signor described some temperature control arrangements recommended by The Detroit Edison Co. to customers on occasion. Connection of the thermostat bulbs to a nearby pipe loop is recommended. An orifice in the loop delays the heating of the loop until steam has reached the remote radiation.

The engineers recommend the use of a 1/2 in. control valve in the pilot line of a single seated fiber disk type pressure regulating valve being used as a shutoff valve instead of a larger one in the steam line itself. Other recommendations concerned the use of master control valves, orifices, and control panel boxes.

Use of Cooling Towers Almost Universal

As a part of the air conditioning program headed by Robert D. Martin of the Consolidated Edison Co. of New York, Inc., characteristics of cooling towers operated in connection with steam air conditioning were described by Boris A. Dmitrieff, senior engineer of the same utility.

Mr. Dmitrieff said that due to the alarming increase in the demand for water in many places and even where plentiful the increased cost of piping and treating it has resulted in the almost universal use of cooling towers in large air conditioning plants.

Although steam operated refrigeration equipment may require a larger tower, the owning and operating cost may be lower than for an electric system due to a lower energy cost and greater flexibility in selecting equipment.

Compare Costs of Air Conditioning Systems

On the same program, Owen Kuhen, Carrier Corp., compared the operating and owning costs of central air conditioners with room cooler installations. Mr. Kuhen included in his analysis (1) window air conditioning units, (2) a fan-coil unitary system, (3) an overhead duct system, (4) a dual duct system, and (5) a conduit system.

He listed the advantages and disadvantages of each type, using in the study a 30 year old office building 16 stories high with four exposures. It was found to require 400 tons of refrigeration capacity with the central systems or considerably more with the individual units.

He found the annual overall owning and operating expense of the window unit system, the overhead duct central refrigeration system, and the conduit system to be close together and less than the other two systems. However, in his functional comparison he rated the conduit system and the double duct system as the best ones.

Creative Approach Solves Problems

In his paper "Creative Thinking Makes Central Plant Steam Economical," a feature of the program of the sales development committee headed by James W. Heaton, supervisor, industrial engineering division, Philadelphia Electric Co., Salvatore S. Guzzardi, consulting engineer of the same city, urged an imaginative and creative approach to the solution of problems rather than the acceptance of past and present methods. He said conditions change, calling for improved procedures. Ideas can be stimulated best by groups wherein all participate, question, observe, predict, and associate in a proper atmosphere, rather than by individuals.

Evaluation must be restrained temporarily. Progress is made through failure as well as through success.

Mr. Guzzardi then said that the usual procedure for selling district steam is to observe existing conditions, determine steam consumption, and make recommendations, giving advantages.

The use of unfamiliar technical terms in the report may cause the owner to turn the report over to his engineers who may want to justify existing methods and hesitate to recommend something new, so the executive not having an enthusiastic approval delays his decision.

The author then described nine instances where savings were made by reduction or elimination of steam use, reduction of the maximum steam demand or reduction of labor.

He concluded by recommending that reports be simple, clear and concise, that conclusions and advantages be given in a paragraph or two in the transmittal letter, and that a meeting with top management be arranged to be held as soon as possible after the report has been delivered.

Temperature Control System Cuts Operating Costs

A year ago Norman H. Davidson, sales engineer, Rochester, N.Y., Gas and Electric Corp., described a temperature control system consisting of a pilot operated pressure regulating valve with a solenoid valve added in the exhaust line of the pilot valve. Shutting the solenoid valve closes the main valve, and vice versa. The opening time of the main valve can be varied over a wide range to suit each heating system.

At this year's meeting, Mr. Davidson presented operating data from four buildings heated by district steam and one with its own heating plant, where these installations have been in use for at least one heating season.

Mr. Davidson's figures show annual savings of between 7.4 and 17.2 percent in four of the buildings having steam service and from 15.8 to 26.6 percent in the building having its own boiler. During the second season, one building which the previous season had shown a saving of 7.4 percent, showed an increased use of 4.1 percent. However, this was due, Mr. Davidson said, to the installation of additional radiation to maintain a higher temperature and to a change in building operation.

How Utility Can Have Profitable Steam Business

Milton I. Allen, vice president of the Philadelphia Electric Co. in charge of the sale of electricity, gas, and steam addressed the meeting on the subject "Management Looks at the Steam Business." Mr. Allen said that in Philadelphia steam is one of the three products they have to sell. Therefore, they are going to promote it and sell it just as aggressively as they know how. He said that to have a continuing profitable steam business a utility must:

1) Continuously, intelligently promote steam service by means of an aggressive sales program.

2) Set the rate to assure an adequate return.

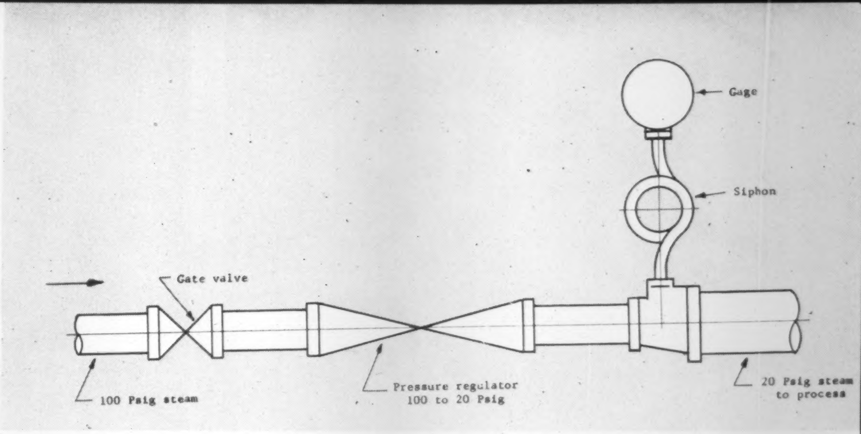
3) In all departments concerned, do everything possible to keep costs at a minimum.

4) Be a good citizen in the redevelopment of the area in its city where it supplies steam, tempering any decisions with sound business judgment. ‡

BEFORE

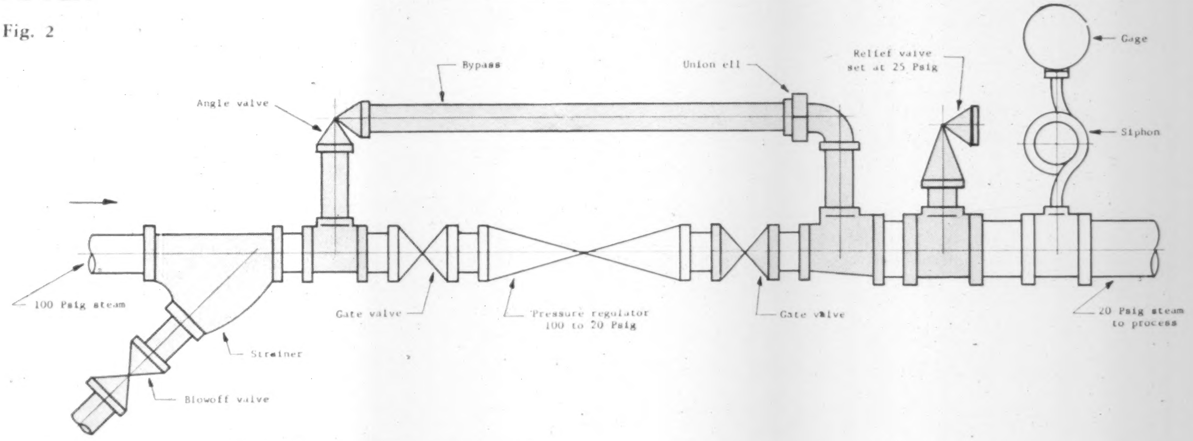
THE simple, workable pressure regulator system, right, affords greater convenience and safety with the addition, below, of such accessories as a gate valve on each side of the regulator; a bypass; a strainer with a blowoff ahead of the pressure reducing station; and a relief valve

Fig. 1



AFTER

Fig. 2



Piping "Trinkets"

. . . *increase efficiency, convenience economy, and safety of piping systems*

BY G. W. HAUCK
Manager, Engineering Sales
Crane Co.

YOU WOULD NOT ordinarily associate the term "trinket" with piping. However, one definition of trinket suggests a way in which it can be applied to piping very appropriately.

According to Webster, a trinket is "something which is added to embellish the whole."

This definition implies that a trinket is an accessory, being less in size and scope than that to which it is added. When designing and installing piping you can find many places for the addition of useful and very practical trinkets. In many cases, they may properly be regarded strictly as trinkets because without them the piping actually is operative. However, the same piping system can be operated more efficiently and conveniently — sometimes with greater safety or economy — if the trinkets are added. When these piping trinkets are applied judiciously, they pay their own way in short order.

Take, for example, the simple form of pressure regulator installation in Fig. 1. (Size has no bearing on the comments.) This hookup not only represents the utmost simplicity; it actually is workable. However, you see the very minimum of equipment, without any provision for contingencies, operating ease, or safety. Let's see what the addition of a few piping trinkets will accomplish.

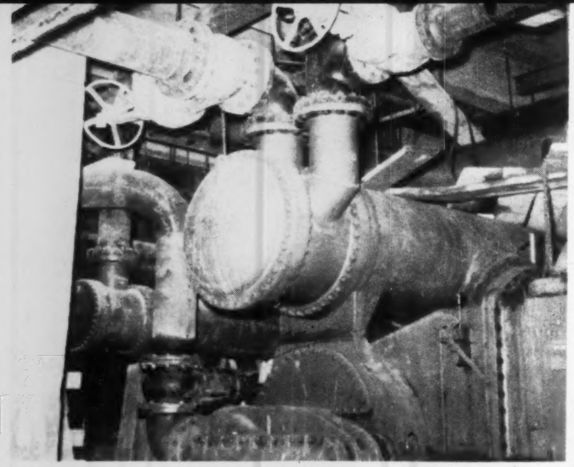
Fig. 2 shows the same installation plus some useful trinkets that can be justified. A gate valve has been put on each side of the regulator and a bypass has been added. The bypass permits the removal of the regulator for repairs without interrupting service. Simplifying one such maintenance operation on the regulator will more than offset the cost of the piping trinkets that were added. The proper sizing of bypasses and selection of the right type of valve are, of course, important.

Another trinket — a strainer with a blowoff — has been installed ahead of the pressure reducing station. This protects the regulator and the valves against the ravages of foreign matter in the piping. It also provides a means for removing accumulated water before starting up after any shutdown.

A relief valve also has been added as a safety measure; it protects the low pressure piping and the connected equipment. This prevents the damage that could occur should the regulator fail to function properly and allow the pressure to build up on the low pressure side. The ASA Code for Pressure Piping deals with this precaution in Paragraph 108. ⧺

The author is a member of HPAC's board of consulting and contributing editors and has prepared numerous piping articles for publication in HPAC.

Additional examples of piping trinkets will appear in future issues of HPAC.



EQUIPMENT ROOM in subbasement contains condenser over chiller, center, with piping connected; centrifugal compressor, lower right; and steam condenser, rear

SOCONY MOBIL building, one of New York's newest structures, is the largest commercial building ever to be completely air conditioned at the time of construction

Cut Cost of Big Building Air Conditioning System Five Ways

. . . by incorporating special features in the design

- **two high velocity air distribution systems**
- **flexibility of systems for space changes**
- **maximum utilization of steam**
- **reduced amount of piping**
- **two separate refrigeration plants**

BY JOHN J. MANN
Jaros, Baum & Bolles
Consulting Engineers

As told to HPAC

UNUSUAL DESIGN FEATURES can sometimes appreciably reduce the installation cost of an air conditioning system for a large building. Such was the case in the new 45 story Socony Mobil building in New York City, the largest commercial building ever to be completely air conditioned at the time of construction.

A total of 4000 tons of air conditioning capacity is installed. Three steam turbine driven centrifugal compressors totaling 2600 tons are in the subbasement. Three steam absorption refrigeration machines totaling 1400 tons of capacity are in the penthouse.

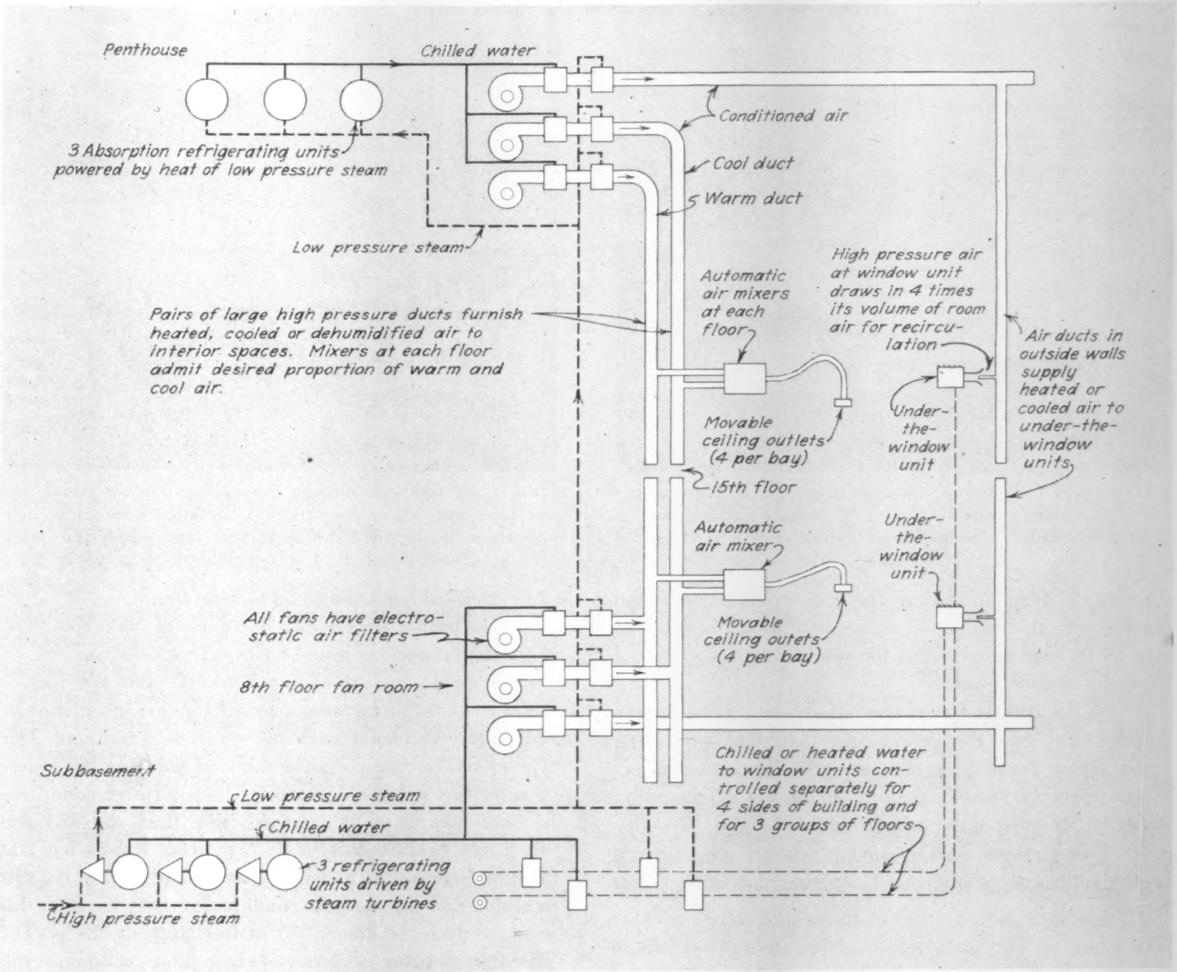
Many new ideas were incorporated in the construction of this 1.3 million sq ft net rentable floor area to keep the cost per ton of air conditioning to about $1230 and the cost per sq ft of air conditioned space to about $4.00. These figures are considerably lower than the average cost of air conditioning new buildings under construction in New York City.

Cite Five Reasons for Lower Cost

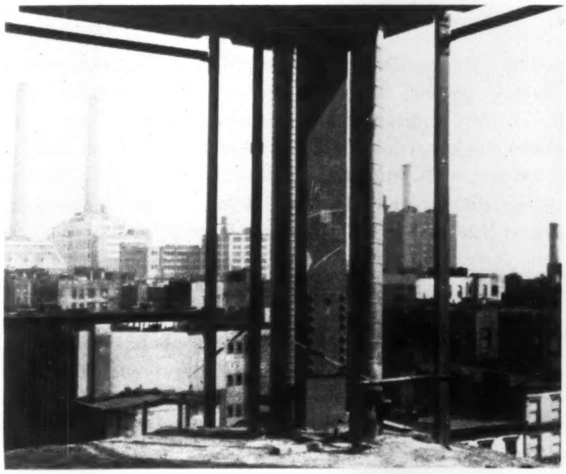
1) The two high velocity air distribution systems serve the interior areas through ceiling diffusers, and a separate system uses under-the-window units for the exterior of the building.

2) The flexibility of the basic system accommodates office changes with no effect upon operation and at a minimum cost to tenants.

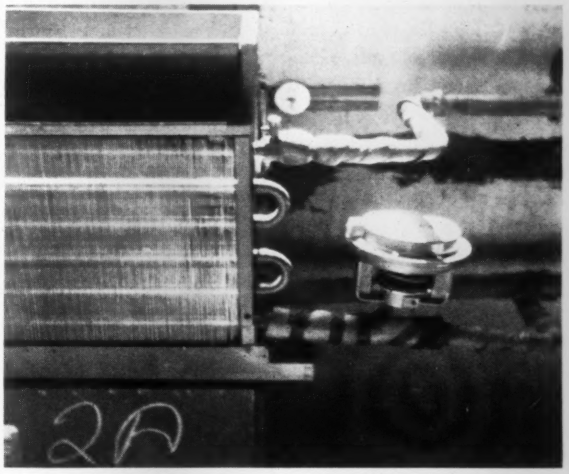
3) The maximum utilization of steam for driving the refrigeration compressors in the subbasement and the ex-


Penthouse
Chilled water
Conditioned air
3 Absorption refrigerating units powered by heat of low pressure steam
Cool duct
Warm duct
Low pressure steam
High pressure air at window unit draws in 4 times its volume of room air for recirculation
Automatic air mixers at each floor
Pairs of large high pressure ducts furnish heated, cooled or dehumidified air to interior spaces. Mixers at each floor admit desired proportion of warm and cool air.
Air ducts in outside walls supply heated or cooled air to under-the-window units
Under-the-window unit
Movable ceiling outlets (4 per bay)
15th floor
Automatic air mixer
Under-the-window unit
All fans have electrostatic air filters
Movable ceiling outets (4 per bay)
8th floor fan room
Chilled or heated water to window units controlled separately for 4 sides of building and for 3 groups of floors
Subbasement
Low pressure steam
Chilled water
3 refrigerating units driven by steam turbines
High pressure steam

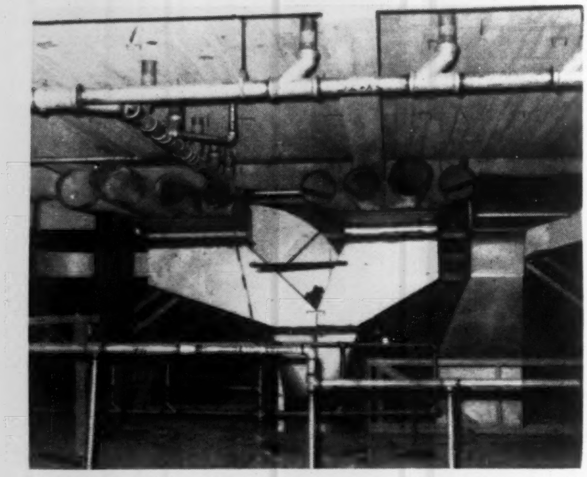
TWO PART STRUCTURE is reflected in air conditioning design. The building is divided into a lower 14 story block and a 30 story tower on top. The chilled water and air handling systems supplied from the subbasement and penthouse are not connected in any way



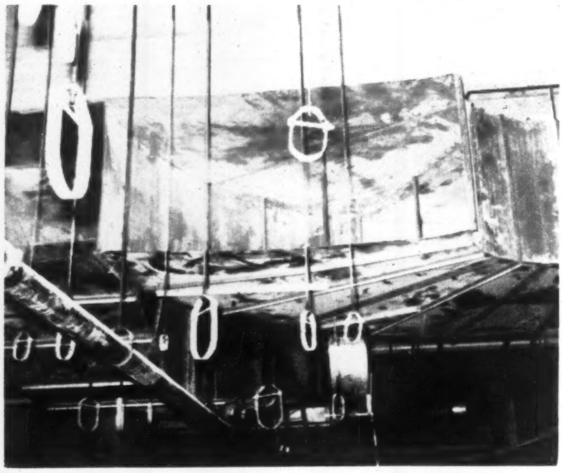
PERIMETER RISERS running next to column of building at this sixth floor location include primary air supply ducts and secondary water piping. Note insulation



COIL CONNECTIONS of under-the-window units have thermostatic control valve on supply branch of secondary water line, which supplies hot water in winter, chilled in summer



INTERIOR DUCTWORK branches from 34 in. diam supply main from subbasement to two 12 × 50 in. ducts and then to eight round ducts at second floor. Return duct is at right



PIPE HANGERS pass through ductwork to support piping that was later installed under this duct. Installed were 14 in. low pressure steam supply and 8 in. chilled water supply and return

traction of steam for use in the absorption refrigeration machines in the penthouse. Steam is re-used from step to step all the way to returning the condensate to the cooling tower for makeup water.

4) No chilled water piping is required between the eighth floor and the penthouse. Also, the condensing water piping from the subbasement to the cooling towers is considerably smaller than if all of the refrigerating capacity had been in the subbasement.

5) Two separate refrigerating plants are used. One is in the subbasement and one is on the roof in the penthouse.

High Velocity Air Systems Key to Economy

The air for the interior of the building is delivered through two sets of two high velocity vertical ducts. One duct is for warm air and one for cool air. The velocities in these ducts are about 4000 fpm. The ducts are in vertical shafts at each end of the center core of the building, and the shafts also serve as return air plenums. At every floor there is a takeoff through a temperature mixing box to a single trunk duct in the ceiling of the corridor surrounding the core. The trunk duct is continuous and is supplied from mixing boxes at both ends of the core. In this way any abnormal demand for air can be supplied from either or both mixing boxes.

The trunk duct supplies a series of radial supply ducts which deliver air to sound absorbing boxes which in turn supply air to four fireproof flexible ducts extending to ceiling diffusers.

All duct sizes and velocities were decided based on the comparison of additional cost of sound treatment and higher fan horsepower against the reduction in material of smaller duct sizes, duct shafts, and floor-to-floor height. The velocities for the various parts of the distribution system are:

a) Vertical trunk ducts, up to 4000 fpm.
b) Horizontal floor trunk ducts, up to 3000 fpm.
c) Radial ducts to sound boxes, up to 2500 fpm.
d) Flexible ducts to ceiling diffusers, up to 900 fpm.

Electrostatic filters were selected for this installation to reduce the maintenance on the spray dehumidifiers. This type of filter can aid considerably in reducing the source of corrosion in these systems as the corrosive conditions in recirculating spray systems come from the dirt and other foreign materials in the air. Also, it was felt that effective removal of airborne dusts would reduce the dirt accumulation in the air conditioning system, and this would reduce the amount of maintenance on the system. The high cleaning efficiency of these filters will also result in a considerable reduction of overall housekeeping costs for the building. The use of electrostatic filters will also undoubtedly increase the life of the acoustical material.

Overdesign for Two Main Reasons

The air conditioning system is designed with excess capacity because of special tenant requirements. An approximate 10 percent increase in capacity is provided above the normal load of one person per 100 sq ft, 5½ watts per sq ft, and with an introduction of 0.35 cfm of outside air per sq ft. The total supply air rate is 0.85 cfm per sq ft of floor area. Two main reasons for this decision are:

1) New office procedures are constantly becoming more mechanized with calculating machines, electric typewriters, and computers which increase the electrical load greatly.

2) New office furniture is reducing the space requirements in large departments with employees taking only 50 sq ft or less. Greater occupancy loads will inevitably be experienced as this becomes standard practice.

These two reasons made the decision to increase the capacity of systems by 10 percent logical and sound.

Three Main Equipment Locations

To keep valubale floor space at a rentable maximum, most of the heavy equipment is in three main areas. In the subbasement three steam turbine driven centrifugal compressors with a refrigeration capacity of 2600 tons are installed. This refrigeration plant serves all of the chilled water requirements up through the 14th floor. This includes supply to the dehumidifiers in the subbasement and the eighth floor fan rooms and chilled water distribution to the exterior cooling coils in the under-the-window units up through the 14th floor.

Also in the subbasement are three motor driven condensing water pumps that recirculate condensing water through the cooling towers and through the steam and refrigerant condensers. Three motor driven chilled water pumps that circulate chilled water through the cooling coils are also installed in the subbasement. Fan equipment serving the subbasement to the second floor is in the subbasement.

At the eighth floor are the fans for conditioned air used on the third to the 14th floors.

The penthouse installation consists of three absorption refrigeration machines totaling 1400 tons of capacity. There is a separate 100 ton refrigeration plant and fan room in the penthouse to serve a private luncheon club on the 42nd floor. Three chilled water pumps and three condensing water pumps similar to those in the subbasement, plus a fan room similar to the one on the eighth floor, are also in the penthouse installation. This plant serves the 15th through the 42nd floors.

Use Steam Twice for Economy

A unique system using steam for both heating and air conditioning utilizes the same steam twice. High pressure steam from the Consolidated Edison Co. is piped into the subbasement to operate the three steam turbine driven refrigeration compressors. One of the 1000 ton units is driven by a bleeder or extraction turbine.

Exhaust steam from the extraction turbine at 20 psig is piped to the penthouse, where it operates the 1400 tons of absorption refrigeration equipment serving the top 28 floors. A portion of this extraction steam is delivered to the central air conditioning units on the eighth floor and also on the penthouse where it is used to adjust the temperature of the air being delivered for distribution through the high velocity ducts. The condensed steam from these coils and the absorption equipment is also used in a heat exchanger to heat water used in the interior zone reheat coils.

Finally, the condensed steam is discharged to the cooling towers as replacement for water lost by evaporation. A live steam makeup connection to the 20 psig riser replaces the exhaust steam whenever the turbine is not operating. This riser also supplies steam for heating when needed. The riser is provided with steam relief valves at the top and may thus act as a relief riser for all relief valves throughout the building.

Space Saved in Design

The building is divided into a lower 14 story block and a 30 story tower placed on top. Both parts of the structure warrant consideration of each as a separate building, and many of the mechanical features were designed to reflect this.

The chilled water and air handling systems supplied from the subbasement and penthouse are not connected in any way. This eliminated a chilled water riser for the full height of the building. Also, the condenser water supply and return pipe systems between the subbasement and the cooling towers is only two-thirds of the size that would be otherwise required. This, of course, is because one-third of the refrigeration capacity is in the penthouse adjacent to the cooling towers.

The subbasement fan rooms supply all ventilating and cooling requirements for the second floor and all lower floors. The eighth floor fan room serves the third to the 14th floors, inclusive. The penthouse fan room serves all floors from 15 to 42, inclusive.

On each floor, the return air passes through ceiling return air intakes, and then flows above the ceiling to the return air shaft. The return air removes much of the heat from the recessed fluorescent light fixtures in this way. Because this heat is removed external to the conditioned area, an appreciable reduction in supply air quantity was possible. Therefore, a reduction in first cost as well as economy in reduced fan horsepower is experienced.

All air systems are designed to introduce 100 percent outside air during the spring and fall, or to use any combination of outside and recirculated air. By taking advantage of the cooling effect of outside air, the operation of the mechanical refrigeration plant can be materially reduced.

Why Two Refrigeration Plants?

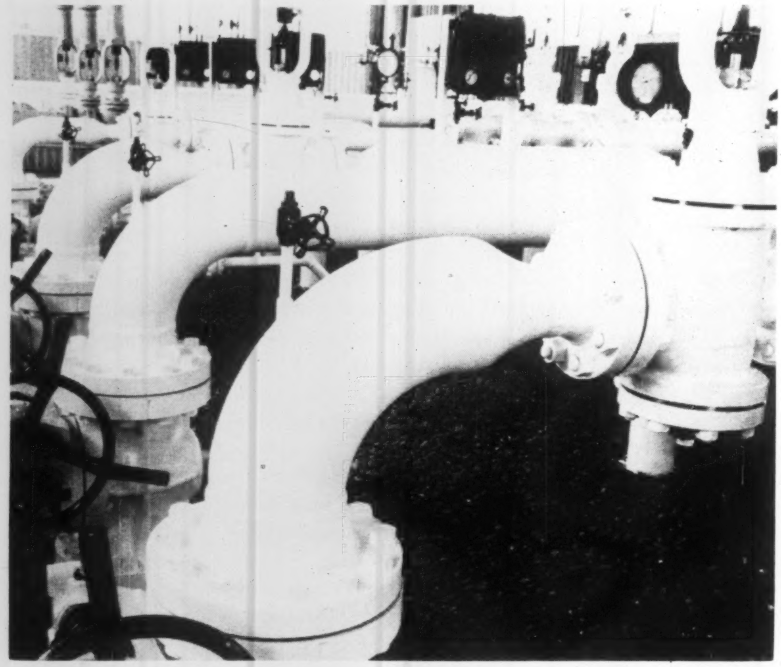
Some of the factors considered in making the decision to install two different refrigeration plants — and why the chilled water lines between them were not interconnected — are listed here:

a) If all of the refrigeration equipment were installed in the subbasement, additional excessive costs of excavation in solid rock and in additional foundation walls would be required. Also, an insulated chilled water supply and return system would be required to the penthouse. Condenser water lines would have to be increased by one-third.

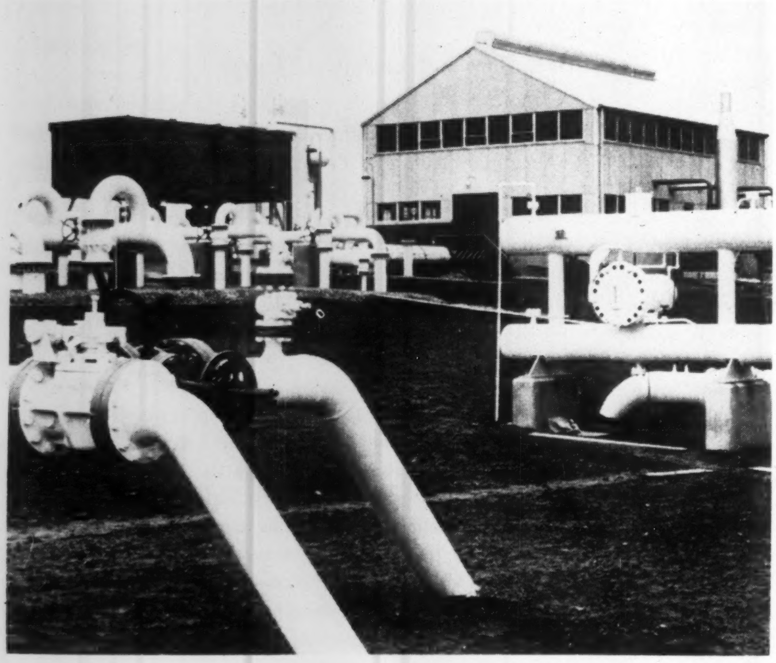
b) If two centrifugal refrigeration systems were installed, one in the subbasement and the other in the penthouse and interconnected through the chilled water line, the heavier weight of the penthouse centrifugal compressors and their foundations would have added considerably to the cost of the structural steel columns.

The architects were Harrison and Abramovitz, John Peterkin, Associated Architects. The air conditioning contractor was Kerby-Saunders, Inc. ‡

Fabricate 170 Tons of Piping



. . . for natural gas compressor-storage plant



BY W. W. ARMSTRONG
Project Engineer
Dravo Corp.

KEEPING PACE with skyrocketing customer demands for natural gas is a problem faced by gas utility companies everywhere. No exception is the Manufacturers Light & Heat Co., Pittsburgh, Pa., in its race to keep ahead of customer requirements.

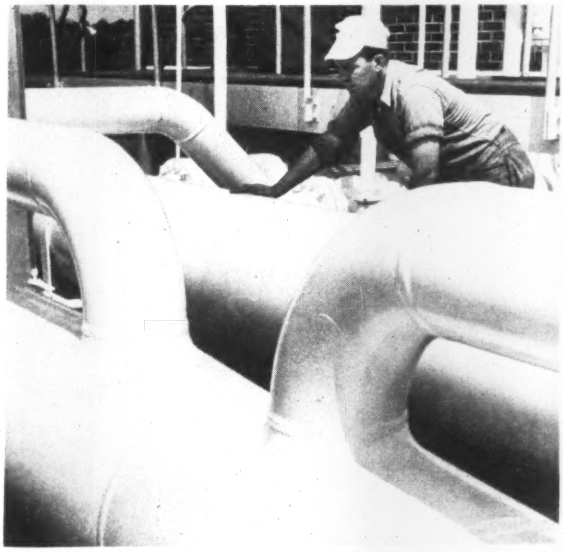
One of the most recent of its expansion projects is the Brinker compressor station and storage field near Lisbon, Ohio. Excess gas coming into the system from the Southwest is discharged underground into the gas sands which were originally depleted many years ago.

Design Pressure Is 500 Psig

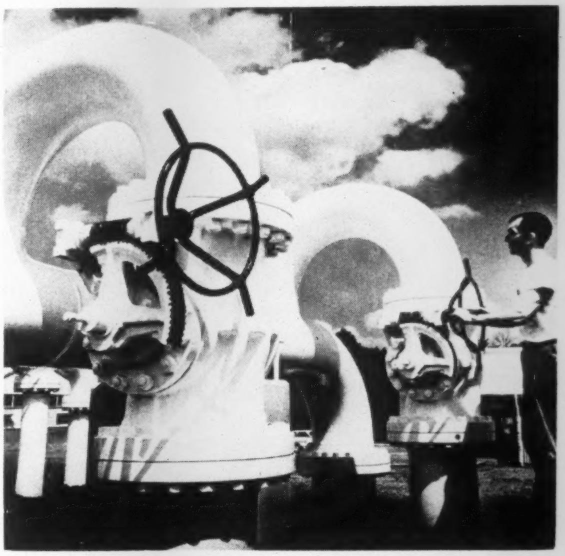
The Brinker station, served by incoming transmission lines, is capable of storing 6½ billion cu ft of gas. The compressor plant is designed for a flow volume of 36 million cu ft a day, and a pressure of 500 psig. Operating pressures are 130 psig suction and 300 psig discharge. Gas coming into the station can be admitted directly to storage or passed on to customers.

Gas from the Tennessee Gas Transmission Co. system enters the station through an 8 in. line at a pressure of approximately 600 psig. From this line gas is passed through a gas heater and odorizer before being reduced in pressure for direct entrance into the underground storage field. The storage field is served by 44 wells, which are connected to the compressor station by one 12 in. and one 16 in. line.

When taken from the field, the gas passes through oil scrubbers to remove foreign particles. From here it enters a 24 in. suction header at the compressor house. After compression to distribution pressures, the gas flows through an aftercooler and then to a measuring and control station



SUCTION AND DISCHARGE lines outside the compressor house are typical of sections prefabricated at the pipe fabrication plant



U-BENDS at the gate nest, where underground lines terminate at the station manifold, were prefabricated and fitted with flanges in the plant and assembled at the site

which feeds the 8 in. lines to Salem, Leetonia, and Lisbon, Ohio.

Use Two 880 Hp Compressors

The compressor station consists of the main compressor house and auxiliary and warehouse buildings. The main and auxiliary buildings are of rigid frame construction, with 4 ft high masonry apron walls of brick exterior and glazed tile interior. Siding and roofs are of corrugated asbestos sheeting and the aluminum window sash is glazed with tinted, light diffusing glass.

The main building contains two 880 hp gas compressors and related equipment. The auxiliary building houses two gas engine driven station generators, the electrical control center, engine starting air compressors, heating boiler, wash rooms, offices.

Piping Fabricated in Shop

Compressor facilities at Brinker required the use of 170 tons of piping, a great part of which was prefabricated at Marietta, Ohio, and transported to the site as needed. The main gas piping, conforming to American Standard Code B31.1, 1951, Sec. 8, and the proposed revision 2 of American Standard Code B31.1.8, is designed for a maximum working pressure of 500 psig. Discharge piping to the aftercooler is designed for a maximum operating temperature of 350 F. Piping downstream from the aftercooler is designed for a maximum operating temperature of 150 F.

All underground yard piping other than main gas lines is protected against corrosion by a covering of enamel and 15 percent asbestos pipe line felt. Walkways of grating are provided at main gas valves outside the compressor house. All main gas valves are flanged at both ends. Those above 6 in. are gear operated. Check valves are in all compressor discharge lines. Faces on the valves and flanges are of the raised face type with flat ring gaskets.

Gas Engines Drive Generators

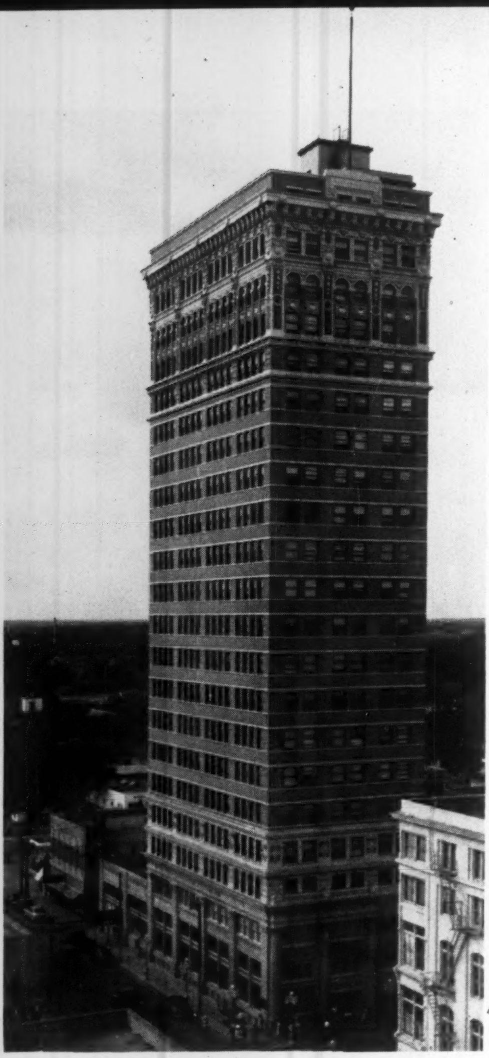
Electrical power for the station is supplied by two 75 kw gas engine driven generators installed in the auxiliary building with standby service supplied by the local utility. The generators are 440 volt, three phase, 60 cycle units. Paralleling is done by automatic synchronizers.

The control center, of metal clad, dead front, cubical design housing, contains the motor starters, generator circuit breakers, and control. Starters for motors of 5 hp and less are full voltage type; larger motors, up to 15 hp, are equipped with reduced voltage resistance starters with one step resistance, two step acceleration. Utility service is supplied at 115/230 volts.

How Plant Is Heated

The plant heating system is designed for temperatures of 60 F inside the main compressor building and 70 F inside the auxiliary building with an outside temperature of zero F. The main building contains four unit space heaters of about 157,000 Btu per hr each. The auxiliary building has two of the same type in the equipment room. The unit heaters in the compressor building are equipped with explosion proof electrical thermostatic controls.

The offices and locker room are heated with two wall-fin radiators rated at 13,400 Btu per hr. The warehouse is heated by two direct fired gas suspended heaters. ⌗



This towerlike 43 year old office building, 50 by 105 by 246 ft high, seemed to defy any practical air conditioning plan. The key to the solution was an old elevator shaft which had been boxed in and forgotten. Now inside the old shaft multiple package units installed on platforms deliver 272 tons of capacity to 95,000 sq ft at $1500 monthly.

It Couldn't Be Air Conditioned ...But They Did It!

WHEN Holt Massey, president of Amicable Life Insurance Co., owner of Amicable Life building in Waco, Texas, and Louis Overton, building manager, finally concluded that they must air condition the 43 year old building to compete with newer office buildings, they called in five different air conditioning engineering consultants. Four of them said the job could not be done; at least not within reason costwise. Too much would have to be torn out and too much added structurally to make such an installation practical, they said.

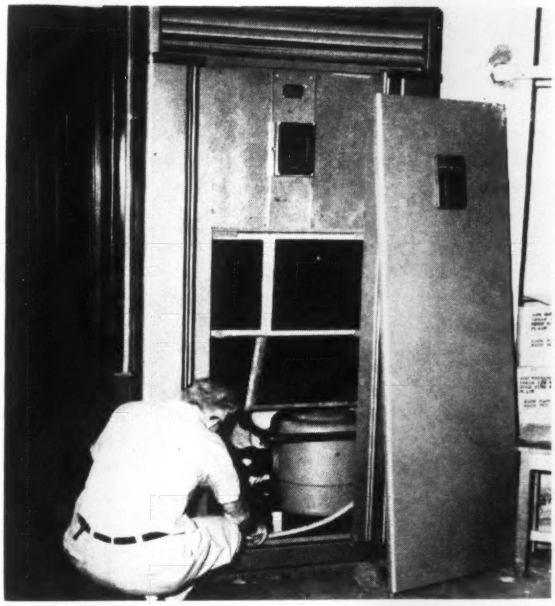
The fifth one said it could be done. They had concentrated on a natural asset of the old building which others had overlooked. It was an old freight elevator shaft, boxed in and long unused. This was the key to the practicality of the ultimate installation.

Amicable Life building was constructed and occupied in 1911, the tallest building in the Southwest and for many years a landmark in central Texas. It is 50 ft wide, 105 ft long, and 246 ft high. It has 85,000 sq ft of usable area.

Thirty-seven individual units deliver 272 tons of air conditioning to all 22 floors at a midsummer operatin cost of $1500 per month, according to Mr. Overton. This is half the estimated cost of operation when the installation was planned and installed.

The 37 units consist of 17 - 10 ton units, 17 - 5 tons each and three of 7½ tons. The 10 ton installations actually are twin 5's. All were manufactured especially for the job and operate on 440 volts.

Each installation has its individual controls, so that any one unit may be cut on or off without affecting the others. All operate on thermostats



MAINTENANCE MAN checks one of 37 individual units in shaft space. Units, which operate independently on separate thermostats, are turned on and off by time clocks

OUTLET VENTS return air from offices to corridors, and through louvered doors to units mounted on platforms of steel beams and concrete flooring in old shaft

which automatically cut them off when the temperature drops below 73 F and switches them on when the temperature climbs to 76 F. One floor, at the request of a majority of the tenants, is set to operate on a minimum of 78 F.

Units are set inside the old elevator shaft on platforms of steel beams and concrete flooring. Metal vented doors cover the units and seal off the shaft so completely that a casual observer does not even know the shaft is there. The vents in the doors permit the discharged air to return from the corridors, where it has been carried from the individual offices through vents in each office wall.

Refrigerated air leaves the units through metal ducts which are 38 × 17 in. at the intake; they graduate down to 22 × 12 in. at the opposite side of the building, but the ducts expand to a maximum width of 45 in. on the turn from the installation into a line with the duct inside the offices.

All ducts are inside the offices, and air is supplied to each office from the duct. Warm air returns through a vent in the wall into the corridor.

Time clocks automatically turn off the units at 9 p.m. and back on at 6:30 a.m. A clock starts a 40 hp pump on the roof at 6:30 in the morning; and after it runs 10 minutes, the conditioning units on the top three floors cut on. Three-floor units cut on in sequence thereafter until the lobby unit starts up before 7:00 a.m. All offices are properly conditioned before tenants come to work.

The two cooling towers are on the roof, with two tanks having a combined capacity of 6000 gal. The system evaporates about 7500 gal of water daily.

Mr. Overton figures that about 45 tons of refrigeration was saved by installing custom made green aluminum screens over all windows. He says the screens reduce the natural temperature inside by at least 10 F.

Cost of the actual air conditioning installation including a year's service was $178,000 — well below the estimate. An additional $52,000, however, went into other improvements at the same time, such as switching over from d-c to a-c current, installation of new boilers, and painting.

The job required only three months, with most of the work done at night, on Saturday afternoons, and Sundays. Not a tenant was disturbed throughout the entire installation operation.

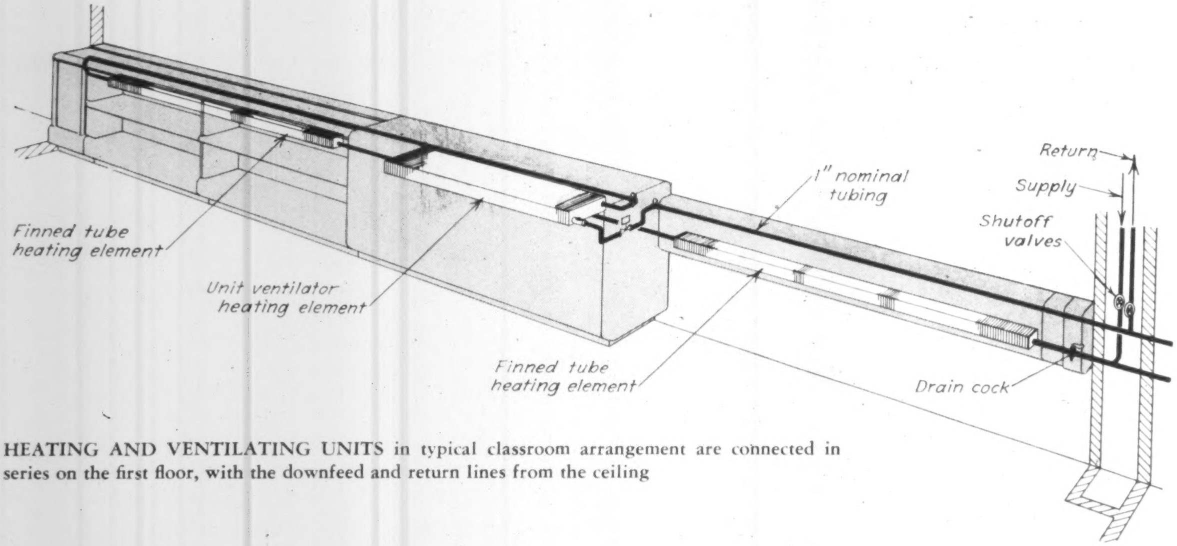
Each unit has manual as well as thermostat control, so that any unit may be cut off manually without disturbing any of the others. When the natural temperature is low enough, only the fans operate, to supply outside air and remove stale air from the building.

The fans operate during the winter and heat comes from the steam heating system which has been in use for many years.

It was estimated that operation in midsummer would cost $3000 per month, instead of the high of $1500 so far indicated. However, Mr. Overton points out, the highest outdoor temperature thus far has been only 101 F. Hotter weather could run the cost up considerably from the $1500 figure so far registered.

All rest rooms are air conditioned by air supplied through branch ducts and exhausted through race pipes to the outside.

The air conditioning engineers and contractor were Texas Distributors, Inc. ⌗


Return
Supply
Shutoff valves
1" nominal tubing
Finned tube heating element
Unit ventilator heating element
Finned tube heating element
Drain cock

HEATING AND VENTILATING UNITS in typical classroom arrangement are connected in series on the first floor, with the downfeed and return lines from the ceiling

Going to Heat School with Hot Water?

. . . here's how one school was heated

Some of the design objectives for this installation were:

- **Design for a 40 F temperature drop, from 230 F supply water, to reduce flow rate by one-half and permit smaller piping and pumps.**
- **Mix return water with boiler water, so temperature in each main is the same.**
- **Vary water temperature of the system with outdoor temperature.**
- **Supplement unit ventilators and heaters with extended surface radiation.**
- **Provide constant flow of hot water through extended surface radiation.**
- **Install hot water supply and return mains to classrooms above corridor ceiling, with reverse return arrangement to facilitate balancing system.**
- **Reduce pumping head on the boiler by locating pumps on boiler outlet to permit lower operating pressure.**
- **Plan heating and ventilating services for future expansion of facilities, and as far as possible install units.**
- **Heat and ventilate gymnasium-auditorium with large volume air handling units connected to ductwork and diffusers for proper air distribution.**
- **Use residual heat in the return air to warm the walls of the building by returning the air through cavity wall spaces leading to a natural plenum created by the outside walls, suspended ceiling, and roof slab overhead.**
- **Reduce danger of interrupted operation of the system in case of protracted electrical power failure by wiring units into the emergency generator circuit.**

BY HENRY C. MILLINGTON
Asst. Head, Heating, Ventilating, and
Air Conditioning Dept.
The Ballinger Co.
Architects and Engineers

HIGHER TEMPERATURE hot water heating systems are still not too common in schools, although such installations are becoming more frequent. Especially growing — where hot water is specified as the heating medium — is the trend for higher initial water temperature and greater temperature drop, not only in schools but also in other public and institutional, and in commercial and industrial buildings.

Among the advantages of higher temperature water are lower initial cost of the installation, lower operating cost, and more economical and responsive temperature control.

There are several design features and variations which make these savings possible. Take, for example, the system installed in the new Penncrest junior-senior high school, Middletown township, Delaware county, Pa., one of the first large school buildings in the Eastern U. S. to use higher temperature hot water.

This school contains 25 standard classrooms, two combination gymnasium-auditorium rooms with stage and equipment, library, five science rooms, health education room, cafeteria and kitchen, two infirmaries, three home economics rooms, band room, chorus room, three double size shops for wood, plastics, electric, ceramics, art metal, hot metal, graphic arts, and mechanical drawing, music library, music practice suite, and a complete administration suite.

Floors are reinforced concrete slab-on-grade. Cafeteria, library, and classroom wings are of window wall construction, all others are of 8 in. brick.

Heat, Ventilate School for $1.63 per Sq Ft

In the Penncrest school each boiler has a 6 in. lead discharging into a 10 in. boiler header. Each pump draws boiler water from this header and a 10 in. return header through a three way valve. The pumps discharge this blended water into a 10 in. supply header, from which five supply mains distribute hot water to various sections of the building.

The school's piping system is installed as follows:

a) a 2½ in. hot water supply and return main running underground through an insulating concrete duct to the shop building approximately 85 ft south of the boiler room,

b) 4 in. supply and return mains to the gymnasium locker rooms, library, south portion of main entrance lobby and classroom wing,

c) 2½ in. supply and return mains to gymnasium large volume heating and ventilating units and gymnasium clerestory windows,

d) 2½ in. supply and return mains to band room, chorus room, home making section, cafeteria, administration suite, and north portion of main lobby, and

e) 4 in. supply and return mains to the future classroom wing and auditorium.

The 4½ in. supply to the classroom wing is approximately 600 ft long which at present is the longest supply main with a length — supply and return mains — of approximately 1300 ft. However, the length of the piping circuit for the future classroom wing and auditorium will be about 1500 ft.

The heating and ventilating contract amounted to $155,051 with an additional $4900 for installing hot water supply and return mains for the future classroom-auditorium wing. This represents heating and ventilating costs of 10½ percent of the total building contract or $1.63 per sq ft of building.

Unit Ventilators Operate On Four Cycles

The unit ventilators may be adjusted to operate on the following four distinct cycles for ventilation control:

a) All outdoor air.

b) Variable quantity of outdoor air with a fixed minimum.

c) Variable quantity of outdoor air without a fixed minimum.

d) A combination cycle.

These cycles provide different sequences of radiator and damper operation for mixing outdoor and room air. In all four cycles, the damper is closed to outdoor air until the room air temperature is just below the thermostat setting.

Convection air currents activated by the extended surface heating elements assure a uniform temperature from floor to ceiling and along the window exposures. This overcomes cold downdrafts, and it raises the temperature of cold surfaces, which decrease the radiant temperature differential between room occupants and the low temperature surfaces.

Heating elements are of aluminum fins mechanically bonded to seamless copper tubing. The corrugated fin provides additional transfer surface, increased rigidity, eliminates sharp edges, and is easy to handle and install. Continuous runs of these fins can be assembled to any length from standard elements.

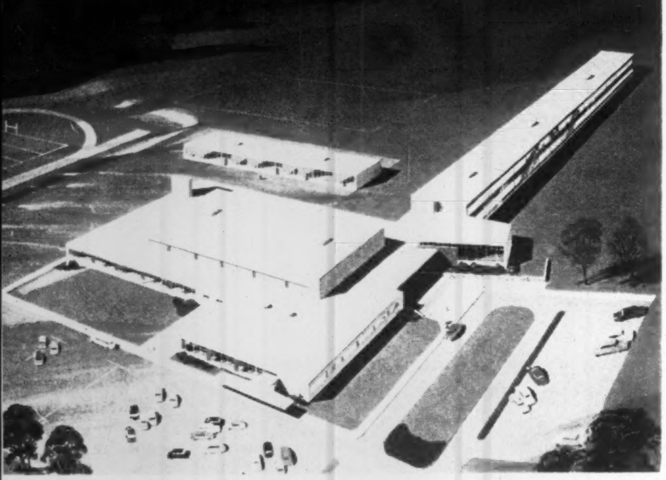
The forced circulation hot water lines require little or no pitch for water flow, though air venting is provided at the high points. Also, the piping was simplified by running the mains above the corridor ceiling. The branch pipes were installed above the classroom ceiling to the outside wall, where they upfeed to the second floor and downfeed to the first floor. This method of branch takeoff and natural swing joints to the heating units provides ample movement for expansion and contraction.

This system was designed for a 40 F temperature drop, 230 F entering the heating elements and 190 F leaving, instead of the conventional 20 F drop. Thus, one-half of the quantity of water is circulated. Smaller size piping and pumps are employed, resulting in a lower initial cost and less power consumption for pumping. This reduction in the normal flow rate and correspondingly greater temperature drop provides an economical and responsive temperature control.

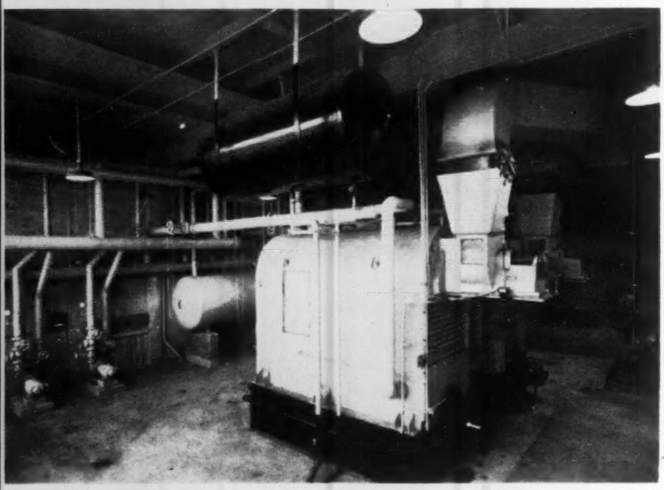
Had this 40 F temperature drop been employed between, say 190 F and 150 F, the average temperature would have been 170 F. At this temperature, the rate of heat transfer is correspondingly reduced.

Mix Return and Supply Water

With this system, hot water temperatures of 230 F fill the needs of heating the school at zero F. And 100 F water would suffice for an outside air temperature of 70 F. At succeeding temperatures down the scale from 70 F, water is required at increasing temperatures up to 230 F.



NEW SCHOOL accommodating some 1000 junior and senior high school students is one of the largest schools in the Eastern U. S. heated by a higher temperature hot water system



BOILER ROOM has two 60 psig boilers of the straight tube pattern. They have a combined design capacity of 7 million Btu per hr. Space in the foreground is for a third boiler

By mixing return water with boiler water, these varying temperatures are achieved at a lower than normal cost. The temperature in each main is the same. Single mains can be energized, a single room can be heated with individual thermostat control by varying the quantities of water flow through the individual room heating units. The rest of the water is bypassed.

Extended surface radiation units supplement the unit ventilators and heaters in classrooms. These radiation units are concealed in storage cabinet pipe spaces or radiation covers and serve as supply and return runouts and an effective means of continuous circulation and balancing.

The water temperature of the system, as previously explained, is varied with the outdoor temperature resulting in close room temperature control.

Zoning was unnecessary because approximately 90 percent of the heating capacity is controlled by individual thermostats.

Two hot water circulating pumps serve the entire heating system, with a third pump as a standby.

Reduce Pressure Head on the Boiler

The two water tube 30 psig boilers of the straight tube pattern, fired with electrically preheated No. 5 fuel oil, are capable of heating the building to the required 70 F at zero F outside temperature and heating 1640 gph of domestic hot water from 40 F to 140 F. The boilers have a total design capacity of 7 million Btu per hr. Foundations for an additional boiler and pump have been installed to provide augmented system capacity.

Because pumps now available can handle the higher temperature water, it is possible to reduce the total pressure head on the boiler by the full amount of the friction loss through the entire system. The pumps, operating to feed the mains from the boilers, obtain the maximum pressure needed throughout the entire system. Thereby, the head on the boiler is reduced, making it possible to use a lower pressure boiler than might otherwise be used. On this system, a 30 psig boiler would actually satisfy the steam pressure load as well as both the static and the pumping head.

Continuously Circulate Hot Water

The piping was arranged to avoid any stagnation of flow. As explained earlier, the temperature of the circulating water is regulated in relation to outside air temperature. The water continuously circulates through the supplementary extended heating surface, providing ample protection against freezeup, eliminating radiation to the cold outside wall and cold downdrafts from the windows.

The water is circulated in series through the extended heating surface and the heating and ventilating units, or is bypassed as demanded by the room thermostat control. Any desired degree from total bypass to the desired degree of heating load on the ventilating unit can be secured by the automatic regulating valve.

By providing for this constant flow of hot water through classroom extended surface loops, there is less probability of freezeup in the event the outdoor dampers fail to close by the downstream low limit thermostat control. If the dampers did remain open, subfreezing air would blow in across the unit ventilator heating element. Incidentally, the pumps are arranged to operate continuously until stopped automatically by an outdoor controller set at 70 F outside temperature.

The long mains above the corridor ceiling made a reverse return piping arrangement to facilitate more accurate balancing of the system.

Hot water circulating pumps were formerly limited to circulating the lower temperature water in the returns; therefore, the pumps had to be on the inlet side of the boilers, subjecting them to the full discharge pressure of the pump.

In recent years, pumps have been developed which are capable of withstanding higher temperature water. These improvements permitted us to place the pumps on the outlet side of the boiler. This new positioning enables the boiler to operate at lower pressures, for no pumping is required to return water to the boiler. Also, because the pressure is lower, the first cost of the boilers is reduced.

Plan, Install Services for Future Expansion

In planning for increase in future enrollment, an additional two story classroom wing and auditorium will be built later, connecting with a corridor common to the existing classroom wing. Mechanical services have been installed for these future facilities, presently terminating at this corridor.

Large Volume Units Heat, Ventilate Gym

The boys' and girls' gymnasiums are heated and ventilated with large volume units, mounted horizontally between the roof trusses. The air from these units is distributed through a conventional system of ductwork and ceiling diffusers. The size and capacity of the gym units was determined by the occupancy and the temperature conditions required when the space is used as an auditorium.

Recirculated air is returned through wall grilles near the floor. Because every room is under a slight pressure, the air then rises vertically through a cavity wall space at the ends of the gymnasium, where it discharges into a natural plenum created by the outside walls, gym ceiling supported from the bottom chord of the roof trusses, and the roof slab overhead.

The rather unique cavity construction makes feasible the use of residual heat in the returned air to warm the walls of the building. This method costs little or nothing extra, either in terms of design construction or heat loss, yet results in a greater comfort in the room because of the higher mean radiant temperature.

The recirculated air is returned to the heating and ventilating unit in this plenum, while the excess air is discharged through two large gravity roof ventilators, one of which relieves warm air heated by spot lights from the stage. When these units are operating under automatic temperature control at 33 1/3 percent outside air — the minimum amount required by the state — this air is relieved through the locker room, where it furnishes air for the locker, shower, and toilet room exhaust systems. This air saves heat by using air that would otherwise be wasted to heat the 100 percent makeup rooms.

Air from the gymnasium locker rooms is then drawn off through the louvered doors and perforated back plates of the lockers to a plenum formed by the sloping tops of the lockers. From this plenum it is collected by ducts, and discharged to the outdoors through a power roof ventilator. During this period of minimum outside air delivery, the automatic dampers of the gymnasium and stage gravity roof ventilators are closed and will not open until the room thermostat positions the controls for admitting 100 percent outside air.

Use Both Pneumatic, Electric Controls

Heating and ventilating equipment in the school is controlled by a pneumatic temperature control system, with the exception of a few rooms. These are controlled manually. In the main lobby, corridors, entrance vestibules, and gymnasium locker rooms, where it was essential to install cabinet type unit heaters for either general heating or tempering air, electric thermostats cycle the unit fans.

Classrooms, chorus room, band and orchestra room. and shops are controlled normally by their individual thermostats during the occupied period. In the unoccupied period, to maintain a predetermined minimum room temperature, the unit ventilator fans cycle and circulate 100 percent recirculated air — they function as unit heaters, under control of a night thermostat in a representative room. There are three of these night thermostats: one for the classroom wing, another for the shops, and the third for the other rooms.

All classroom unit ventilators and the large volume heating and ventilating units for the gymnasiums are programmed to occupied and unoccupied periods by a seven day timer mounted on the automatic temperature control panel in the boiler room. The cafeteria, gymnasiums, library, and administration suite are separately controlled by day-night thermostats so that any of these spaces can be reset to the occupied period by manually operating the keyed switch on the thermostat, thereby disengaging it from the timer control sequence.

All room unit ventilators operate at the required 33 1/3 percent minimum outside air except those for the cafeteria, metals shop, and the combined wood-plastics-electric and ceramic shop, which function at 100 percent minimum outside air.

The unit's thermostatically controlled damper can adjust to provide up to 100 percent outside air, or can, if necessary, shut off completely for full recirculation of air already in the buildings.

Complete recirculation may also take place during such time as the outside temperature might fall below zero F. For any period colder than zero F, outside air can be reduced temporarily below the 33 1/3 percent intake level down to complete recirculation to assure adequate heating even on the coldest days.

Wire Units Into Emergency Generator Circuit

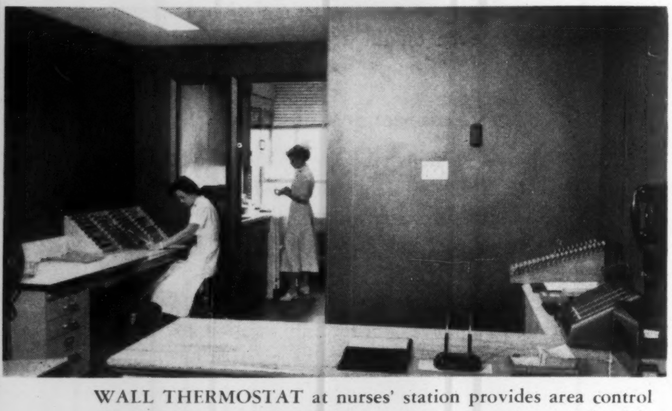
In the last several years, the increase of storms in the Northeastern U. S. has caused concern of protracted electrical power failure. In many instances, both in rural and in suburban areas, several days have been required to restore utility power.

To meet this threat, we found it advisable to reduce the danger of pump and burner interruption by wiring the motor of one of the hot water circulating pumps, the burner, and induced draft fan of one boiler, and the pneumatic control air compressor into an emergency generator circuit. ‡

BAPTIST MEMORIAL HOSPITAL, Jacksonville, Fla., is one of the largest with year 'round air conditioning. Built of reinforced concrete in a modified T shape, it has wide overhangs on all five stories to reduce sun load. It has no basement. Air conditioning equipment is housed in the penthouse and in a connected utility building

550 Ton Steam Absorption System

CEILING DIFFUSERS supply low pressure conditioned air to hospital lobby and other interior zones from air handling units in five equipment rooms on the first and seventh floors



WALL THERMOSTAT at nurses' station provides area control of temperature and humidity. Patients' rooms have individual room control

THE NEW $4½ million Baptist Memorial hospital on the bank of the St. Johns river in the heart of Jacksonville, Fla., is one of the largest in the U. S. to be completely air conditioned for year 'round comfort. It has five stories, 350 beds, and 163,000 sq ft of floor space. The cooling load of 6.6 million Btu per hr is satisfied by a 550 ton steam absorption air conditioning system with 16 zones.

Conditions maintained are 80 F dry bulb, 50 percent relative humidity in summer and 75 F in winter. In operating rooms, nursery, and obstetrics room, conditions are 80 F DB and 55 percent RH year 'round.

Prevent Cross Contamination of Air

A high pressure air distribution system uses 50 percent outdoor air. The recirculated portion does not leave the patients' rooms, which have their own individual exhausts, thereby removing the danger of cross contamination, which has been one of the problems of hospital air conditioning.

Cross contamination and infiltration of air between rooms is prevented by maintaining higher pressure in the corridor systems in the building interior than in the exterior spaces, with an air flow into patients' rooms. A very slight pressure is maintained in the entire building. Operating rooms maintain slightly greater pressure to provide exfiltration to the surgical corridor.

While this system costs more to operate than the more conventional methods used, for example, in an office building of the same cubic footage, it is believed to answer some of the fears that have been expressed by hospital authorities about airborne infections.

The 34 in. main supply duct on the sixth floor pro-

Two 275 ton steam absorption refrigerating units utilizing steam from two 400 hp fire tube boilers provide 45 F chilled water to 16 zones. High pressure air under-the-window units serving patients' rooms are supplied 152 F hot water from a heat exchanger in the equipment room. Low pressure air handling units, which serve other areas, receive steam at 40 psig, except those serving the operating suite which use hot water. Differential air pressures prevent cross contamination and infiltration of air between rooms. The control system is pneumatic. All patients' rooms have oxygen piping outlets.

Conditions New Hospital

vides high pressure air to under the window units in patients' rooms via 3½ in. branch ducts. Air is exhausted into patients' toilets and then into chases which run from the second floor to the fifth floor. These chases are collected by ductwork in the fifth floor ceiling and connected to an exhaust fan on the seventh floor. All duct risers are in the four main chases in the building.

The rest of the building is served by low pressure air systems, being supplied from air handling units in five equipment rooms on the first and seventh floors. Low pressure areas have ceiling diffusers, with manual volume control provided in certain areas. These areas are exhausted by fans on the fifth floor.

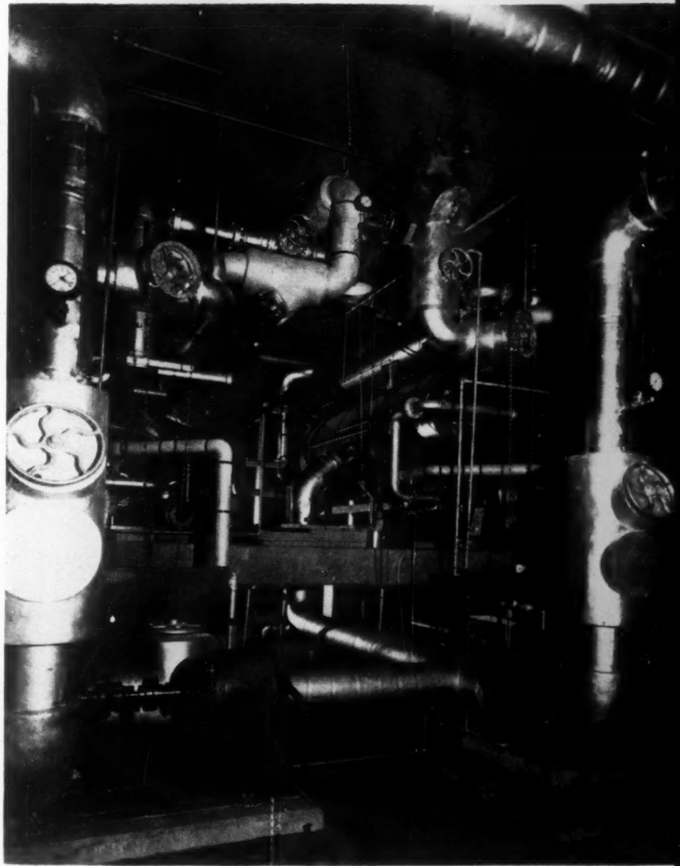
The total air quantity is approximately 74,000 cfm. The volume of the building is about 2¼ million cu ft.

Provide Flexible Control of System

In cool weather the air is passed over heated coils, while in warm weather these coils are supplied with chilled water to cool the air. In the Jacksonville climate, cooled air is needed almost continuously from May to October, but in winter there are temperature variations which might require both cooling and heating within a single 24 hr period. Every room has individual thermostatic control, so that heated or cooled air can be supplied to suit each patient's desire. If a patient wants outside air, the air conditioning system can be shut off for his room and the windows opened.

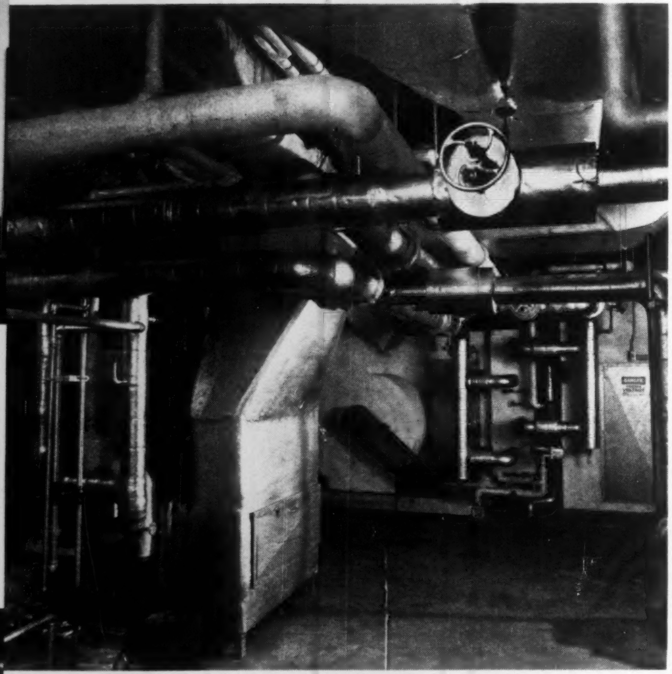
The control system is pneumatic. Thermostats control three-way water valves, steam regulating valves, or outside and return air dampers.

The surgical suite, obstetrics rooms, and nursery all have their own individually controlled systems, and each operating room has its own humidity and temperature



STEAM ABSORPTION REFRIGERATION UNITS installed in penthouse deliver chilled water at 45 F to the air conditioning system. Cooling towers deliver 85 F water to the absorption unit condensing systems

"... It's almost impossible today to operate a hospital



PRIMARY AIR UNIT for surgical suite delivers air at constant temperature and humidity. The air is then reheated by hot water coils controlled by thermostats in operating rooms

BOILER PLANT in $1\frac{1}{2}$ story utility room furnishes 9500 lb of steam per hr for full air conditioning load. Bunker C fuel oil is stored in 15,000 gal tank on waterfront

control. Except for thermostatic settings, these units are fully automatic 24 hr a day.

This type of system provides greater flexibility of operation and individual control of each operating room. Air is delivered to the area at constant temperature and humidity and is reheated by hot water coils controlled by thermostats in each operating room.

A self-contained unit furnishes heat to the incubators in the children's wing.

All of the ductwork is round galvanized steel.

Boiler Plant Installed in Utility Building

Chilled water is delivered from two 275 ton steam absorption machines at 45 F to the system. City water is used for makeup. Cooling towers serving the condenser water system deliver water to the absorption machine condensing systems at 85 F. The two absorption machines are in the sixth story penthouse.

Steam is provided to coils in the air handling units throughout the building at 40 psig. Heat is delivered to the patients' room units by 152 F hot water from a heat exchanger in the main equipment room.

Housed in a connected $1\frac{1}{2}$ story utility building are two 400 hp fire tube boilers. The two boilers furnish 9500 lb of steam per hr for a full load of air conditioning. The boilers are fired with Bunker C fuel oil. The 15,000 gal fuel storage tank is on the waterfront for easy filling by tank or barge. The heating load is 16 million Btu per hr under design conditions.

In the utility building also are the laundry, water treatment plant, and machine shop.

The hospital has a separate refrigeration system for its six cold storage rooms for the preservation of meat and other perishable foods.

Store Oxygen in 125,000 Cu Ft Spherical Tank

All patients' rooms are equipped with wall outlets for piped oxygen. The oxygen is stored in a spherical tank, 8 ft, 6 in. in diameter, at 175 psig and −300 F. The temperature of the oxygen is maintained by a secondary outer shell. The space between the inner shell and the outer shell is about 8 in., in which is maintained a vacuum of 15 microns. The space is also insulated.

The sphere, or the cold converter, is filled through a mobile pumping unit and truck mounted tank with a capacity of 125,000 cu ft. The liquid is pumped through a control cabinet and a series of regulators into the cold converter. Oxygen going from the cold converter to the supply piping system is reduced from 175 psig to 60 psig through an atmospheric vaporizer having a capacity of 5000 cu ft per hr.

The converter is 75 ft from the nearest building wall on the river side of the hospital. It is protected against exposure on two sides by a 10 ft high brick wall. The

without air conditioning, especially in the South."

cold converter has a design pressure of 200 psig and is hydrostatically tested to 400 psig. The inner shell construction is 96 percent copper, 3 percent silicate, and 1 percent manganese. The exterior shell is high carbon steel.

Provide for 20 Percent Expansion

Future expansion of the hospital calls for one additional story on the east and west wings of the main hospital. All air conditioning equipment has been sized for this expansion. Two future floors of the children's hospital are also anticipated.

As of now, the hospital has 334 beds, of which 284 are in the main hospital and 50 beds — plus 70 bassinets — in the children's hospital. Additional 70 beds are planned for the main hospital and 70 for the children's wing, for an ultimate total of 474 beds.

Air Conditioned Rooms Cost Patients No More

According to hospital administrator Lawrence R. Payne, operation of the air conditioning system requires the services of three men who would not be needed if the hospital was not air conditioned. The costs of water and electricity have not been figured separately for the air conditioning system. When one absorption unit is operating, fuel oil consumption is from 50 to 60 gal per hr; with two units operating, it is about 100 gal per hr.

Air conditioning, says Mr. Payne, has unquestionably increased direct operating costs compared to costs in a non-air conditioned hospital. "But there are some compensating factors," he says. "These are intangible, but must be considered, such as the comfort of doctors, nurses, and other staff members and patients, plus the fact that employees work better in comfortable conditions. Doctors, nurses, and patients all appreciate it."

Baptist Memorial hospital charges no more for air conditioned rooms than other Jacksonville hospitals charge for rooms not air conditioned. "Perhaps we should charge more," says Mr. Payne, "but we haven't."

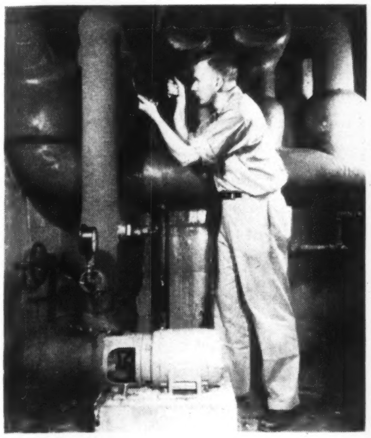
The administrator declares, "It's almost impossible today to operate a hospital without air conditioning, especially in the South. Our summer lasts from May to October. During at least four months of that time daytime maximum temperatures are seldom below 90 F and more often are 95 F or higher.

Architects and engineers were Reynolds, Smith & Hills, of Jacksonville. The general contractor, the Henry G. DuPree Co., installed the air conditioning system and the piping. ǂ

Photos courtesy Reynolds, Smith & Hills.

Small Booster Pump Solves Coolant Pressure Problem

. . . by increasing the head from large primary pumps



WHEN an extra air conditioning load demands more than present capacity from a coolant circulation system, it may pay to put more pressure behind the cooling fluid with a small booster pump, according to the Ingersoll-Rand Co.

This worked to advantage, for example, when the Dime Savings Bank of Brooklyn found it wasn't getting enough head from its large primary pumps to adequately chill the cooling coils in its fifth floor penthouse.

Two 60 hp circulating pumps were pumping chilled water from a pit in the subbasement floor to the penthouse coils — an eight story lift of 150 ft. But they were delivering water to the coils at only 100 gpm under 12 to 24 psi pressure.

For normal air conditioning requirements, the penthouse coils required 250 gpm at 75 psi pressure.

The solution seemed to lie in replacing the primary circulating pumps with newer, more powerful equipment. The pit housing the pumps, however, was too small to accommodate the size required. It could not be enlarged without going to extra expense.

So a 7½ hp single stage electrically driven centrifugal pump was installed just below the chilled water supply header. The small booster pump raised the pressure behind the chilled water, forcing the coolant into the penthouse coils at the required rate.

According to estimates of the bank's supervising engineer, the small booster pump solved the air conditioning problem at less than one-tenth the amount it would have cost to install two new primary pumps. ǂ

The Law and Your Profits

BY WILLIAM HURD HILLYER

Good English Is Essential

. . . contractors find when somebody loses $1000 in contract confusion resulting from a missing verb

HEATING, piping and air conditioning engineers and contractors might well brush up on their English before writing any kind of agreement. In fact, before signing anything they should be sure that the paper is well and clearly expressed, with no essential parts of speech missing. The English, not the law, caused a $1000 loss in the following case.

Jen E. Rawll was the general contractor on a certain building and Cal Tinka was the heating contractor. In the course of the work Rawll, it was later alleged, became indebted to Tinka for a substantial sum, which he found inconvenient to pay. Consequently Tinka took Rawll to see a Mr. Kahn Tragda, another general contractor whom Tinka had known for some time and who was presumably in funds.

Together, according to testimony, they requested from Mr. Tragda a cash advance of $1000 to Tinka, who agreed to pay that sum out of the amount to be received from Rawll under the subcontract. Testimony differed as to what happened from this point on, and the divergencies do not seem to have been resolved.

First, here is Mr. Tragda's version, as given when he sued Jen E. Rawll for moneys had and received:

"I am a contractor. I did not know the defendant Rawll until the sixth day of August . . . . . I knew Cal Tinka and have known him for six or seven years. Mr. Tinka, Mr. Rawll and I had a conversation that day. Cal said he wanted to borrow $1000 and would Mr. Rawll sign for it? He was sitting in the back seat of the car, and Cal wrote it out and Mr. Rawll signed it, and I gave him the money . . . . currency, $1000 bills . . . . . I have seen that piece of paper before. Mr. Tinka's signature is at the bottom. Mr. Rawll signed it," Tragda stated.

The "piece of paper" referred to by plaintiff Tragda read:

"8/6/5-

"I owe Cal Tinka $1538 for . . . . heating in a building on Acropolis road. I agree to Kahn Tragda $1000 of this amount when I pay off.

"Jen E. Rawll
"Sept. 10/5-
"Cal Tinka"

Defendant Jen E. Rawll denied in court that he owed Tragda the $1000 or that any money whatsoever passed between the parties. "Tragda and Tinka came to see me [Rawll] and asked that he agree to pay Tragda $1000 of the amount to be earned by Tinka under the subcontract for a past indebtedness due to Tragda by Tinka. I [Rawll] agreed that whenever Tinka completed the heating work in accordance with the subcontract and I [Rawll] was ready to settle with Tinka, likewise in accordance with the subcontract, then I [Rawll] would pay to Tragda $1000 of the amount earned by Tinka if he and Tragda so desired."

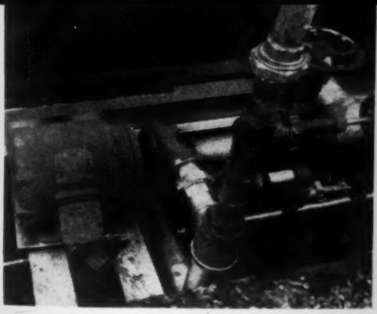
Jen E. Rawll went on to recite that Cal Tinka "failed and refused to comply with said subcontract and defaulted on same," so Rawll was "not indebted to him in any amount by reason of the subcontract." Defendant Rawll further alleged that he had to pay someone else to do the heating work; that Tinka was adjudged a bankrupt and that he, Rawll, received no consideration from Tragda or from Tinka for his agreement to pay Tragda rather than Tinka when Tinka complied with his contract. Specifically, Rawll contended, "the purported agreement was not written with sufficient definiteness to comply with the statute of frauds . . . . and is not enforceable."

The trial court rendered judgment in favor of defendant Rawll and Tragda appealed. After the case had dragged along for three years, the Chief Justice of the state supreme court held, in a supplementary opinion, that the so-called agreement lacked the essentials of a special promise to answer for the debt of another person. Sustaining the lower court's decision, he ruled that "the second sentence is incomplete and uncertain as to meaning. Thus there is no written special promise; an action cannot be maintained on it."

Manifestly the missing verb in the second sentence of the agreement rendered the whole paper meaningless. This is not a case of legal technicalities; it is an instance of such poorly constructed language that the paper cannot be understood by anyone. But someone else seems to have lost $1000 as a result. ‡

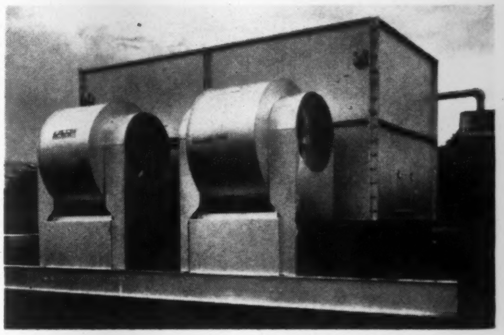
WILLIAM HURD HILLYER, *author of this regular feature, is a contributor to a number of banking and financial publications and has written several books on business. He has an extensive practical legal and financial background.*

This series presents actual cases. Naturally, laws vary in different states. All names are fictitious.



Eight package units ranging from 2 to 10 tons in capacity utilize a single 180 gpm centrifugal water circulating pump, above, and a 60 ton forced draft cooling tower on the roof

Air Conditioning Modernizes Old City Market



THE BIG old city market in Winston-Salem, N.C., is now completely air conditioned, as part of a recent $100,000 modernization program.

Completed at a cost of $500,000 in 1925, the 240 ft by 115 ft building had a lofty ceiling. Independent merchants leased part of the big hall, and farmers brought in produce for sale. Today there are 23 separate retailers.

Some years ago, a supermarket leased the south end of the building, an area 90 by 115 ft, and later subleased a 90 by 36 ft area to another store. The market enclosed its area and installed two air conditioning units utilizing city water, which was then wasted.

Now, to handle varied area loads throughout the building, six additional package units are strategically installed. A 3 ton and two 7½ ton units are installed against walls where perimeter aisles are broad so that no merchant space is used and traffic is not hindered. A 2 ton unit is suspended from the ceiling. Only two 10 ton units take any useful space, and this is only 22½ sq ft.

Two of the units are equipped with outdoor air ducts. All six new conditioners as well as the two existing ones are tied into a single cooling water system, with pipes ranging from 1 to 3 in. in diameter carrying water to the 60 ton forced draft cooling tower on the roof. Capacity of the tower can be increased 20 percent if required by installing another interior deck.

All water for the air conditioning is circulated by a single 2 in. centrifugal pump rated at 180 gpm at a 78 ft total head, and driven at 3500 rpm by a 5 hp induction motor. The pump has a heavy duty mechanical seal instead of the conventional stuffing box. Also, the one piece impeller has an extended hub which protects the motor shaft from corrosion. The weatherproof unit is in the open on the roof beside the cooling tower.

Each of the air conditioners has individual thermostatic control. The operation of the water pump is controlled by the four large package units. An auxiliary contact in each compressor starter turns on the pump motor simultaneously with the compressor. Thus, if any one of the big units starts up, the pump immediately goes to work. In the case of the 2 ton and 3 ton conditioners, the system is reversed, and the units will run only if the pump is in operation. This is achieved by wiring the compressor motor control through a pressure switch in the condenser water supply line which permits the conditioner to run only when the water pressure is over 25 psig. Operation of the units by this control system has been very satisfactory.

The system was installed without disruption of business.

The consulting engineer was Wasell Engineering Service, and the air conditioning contractor was Wall-Turner Co. +

Photos courtesy Ingersoll-Rand Co.

POWER ROOF EXHAUSTERS ventilate operating rooms and toilet facilities in a new wing of the Methodist hospital, Omaha, Neb.

How to Reduce Power Exhauster Noise

- ***Provide additional vibration isolators.***
- ***Be sure the building's harmonics do not synchronize with those of the exhauster.***
- ***Put sound absorbent lining in duct from exhauster to first elbow.***
- ***Don't connect ductwork directly to the exhauster housing.***
- ***Install acoustic materials within the occupied space if low noise level is required.***
- ***Do not specify low speed fractional horsepower single phase motors which have high inherent noise levels.***
- ***Install a sound baffle within the curb beneath the unit.***

BY I. I. SOLZMAN
General Manager
The Gallaher Co.

IF A POWER ROOF EXHAUSTER is properly designed aerodynamically; if it is structurally sound in its design; if it has adequate isolators; and if it is installed with the utmost care, it will be satisfactory, provided that:

- the tip speeds of the fan are not excessive;
- air velocities are not excessive;
- the air quantities are relatively low for each power roof exhauster.

When power roof exhausters are installed on schools, hospitals, office and apartment, and other large buildings, care must be taken in the installation in order to keep noise below the annoying level.

First, however, it is meaningless to talk about the decibel rating of a power roof exhauster except for comparative purposes. And if various makes and designs are to be compared, it is essential that the noise level measurements be made under identical conditions, if they are to have any meaning.

The use of terms, such as "noiseless," to describe equipment is, of course, inaccurate. There is no noiseless piece of moving equipment, since even the bearings will increase the room noise level somewhat. All noise is relative, and if air is moved where machinery is running, the noise of the fans and other equipment will all be added to the normal noise level of the enclosed space.

Although the power roof exhauster was first utilized prior to 1940, its full application did not really come into being until the late 1940's. And like any piece of mechanical equipment, it has a noise factor which must be controlled. Where the noise problem is a critical one, it is evident that there must be close cooperation between manufacturer, engineer, architect, and owner.

Decibel Measures Sound Power

Airborne sound is a variation in normal atmospheric pressures. For a pure tone, the number per second that the pressure changes through a complete cycle is the frequency of the sound. Thus, the standard tone A has a frequency of 440 cycles per second. The extent of variation in pressure is measured in terms of a unit implied with the common term, "the decibel."

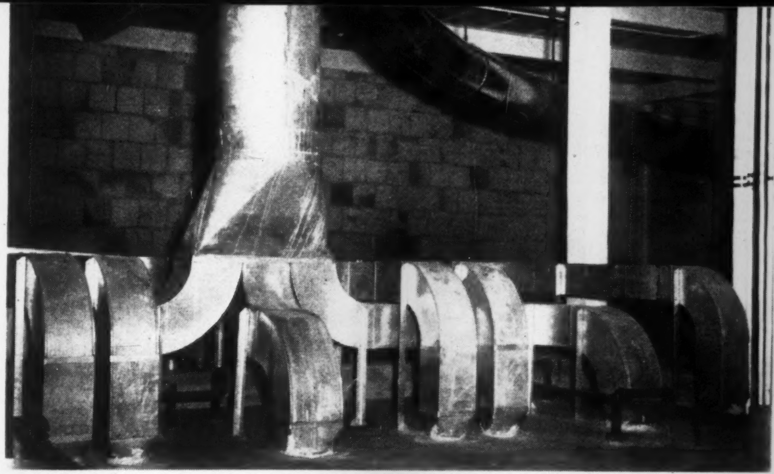
The decibel is a measure of the power of sound and is a logarithm of a ratio of two values of power. Equal changes in decibels represent equal ratios. Therefore when the decibel is used to express noise levels, a reference level is implied. At present, this reference level can be referred to as "zero decibel," the starting point of the scale of noise level.

The starting point is about the level of the weakest sound that can be heard by a person with good hearing in an extremely quiet location. The sound level in the large office usually is between 60 and 70 decibels.

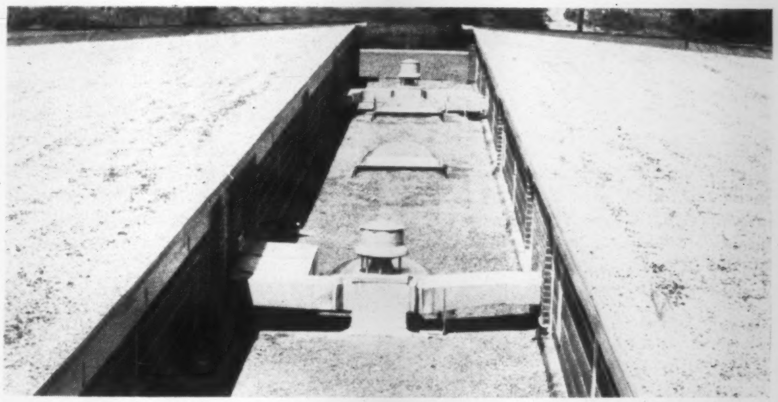
The apparent loudness that we attribute to a sound varies not only with the sound pressure but also with the frequency — or pitch — of the sound. In addition, the way it varies with frequency — rhythm — depends upon the sound pressure.

The physical and mental conditions of the occupants materially affect the annoyance factors of sound. For example, the pecking sound of a typewriter in use probably goes unnoticed by a person who is physically fit; yet to a person suffering from sinusitis or a migraine headache, it might be intolerable.

Architects and engineers interested in the application of exhaust fans are primarily concerned with the annoyance factor of sound and not its power. Also a primary concern is the annoyance factor within the occupied space. This means that frequency or the number of "cycles" of the sound waves is as important as the power, in determining if an installation will be objectionable.



WELL DESIGNED exhauster duct system shown here is installed at the Armour Pharmaceutical laboratory at Kankakee, Ill.



SCHOOL CLASSROOMS, as at this school in Washington state, represent an important ventilation need where quiet operation is necessary.

Noise is Highly Relative

The manufacturer of power roof exhausters can build a power roof exhauster as quiet as it is possible by utilizing internal isolators to reduce the transmission of vibration from the rotating element to the housing of the power exhauster. But from that point on, the architect or engineer, in his directions to the contractor, must take over. And what he does in specifying materials and methods of installation can either reduce or add to the annoyance factor of an installation.

Let us assume that a centrifugal power roof exhauster is to be installed on the roof of a given room. If this room has an acoustically treated ceiling, carpeted floor, papered wall. venetian blinds and draperies, the noise level in this room would produce a certain decibel reading.

Then, let us assume that we make no changes except that we remove the draperies and the venetian blinds; remove the carpet from the floor; and the acoustical treatment from the ceiling, leaving a plaster ceiling, a plaster wall, and a tile floor. Another reading with the same meter in the same location will produce a decibel reading which will be higher than the original reading.

Tiled walls and floors, as in a laboratory, will give an even higher reading.

If we take the same space, and remove the power roof exhauster and install a different type of exhauster with exactly the same capacity reading, and, if we make the same three noise measurements, we will probably have an additional three sets of decibel readings.

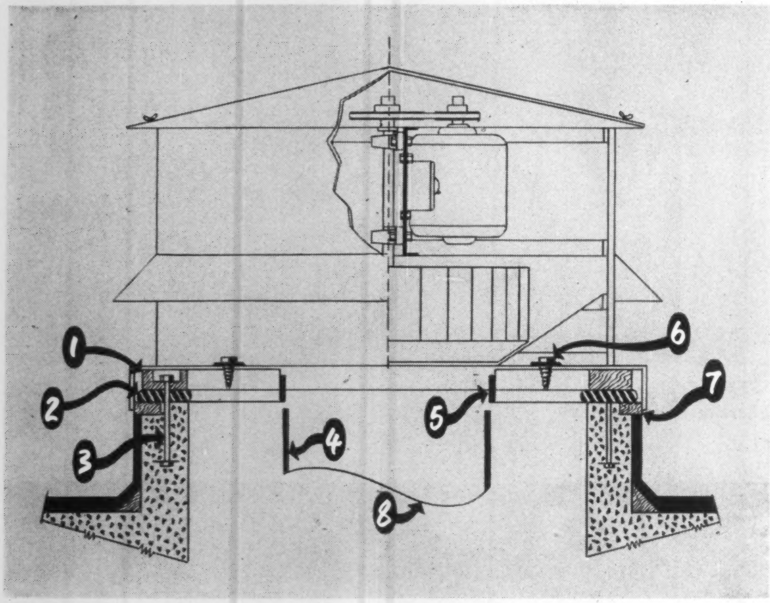
Thus, noise and resulting noise is a highly relative matter. A very quiet power roof exhauster and a rather poor installation and room design may result in a noise problem.

What to Look For

The power roof exhauster can make the job of achieving the quiet installation easier if it has certain features provided in the design. These are:

1) Careful streamlining of the air passages to eliminate, or reduce to a minimum, the possibility of air turbulence.

2) Structurally sound design to



MAXIMUM QUIETNESS can be obtained by following these eight installation tips: (1) Use a 2 × 4 ft wood frame; (2) Use a 1 in. isolation pad; (3) Securely anchor exhauster to the concrete curb; (4) Use acoustical duct lining; (5) Use a gasketed slip fit or fabric connection to reduce vibration; (6) Use 2 in. lag screws with lead washers; (7) Use a 1 × 1 in. nailer strip of wood to further reduce vibration; (8) Make sure that the connecting duct velocities do not exceed 1000 fpm

prevent vibrations from being transmitted.

3) An efficient type of isolator between the rotating elements and the housing. This isolation system must, of course, have a certain amount of rigidity, or mechanical troubles may develop because it is necessary that clearances between the fan inlet and the housing be very close. If the isolators are such that they allow too much flotation of the rotating element, the fan wheel may strike the inlet of the exhauster.

4) Wheels which are properly balanced and structurally sound.

Use Slow Speed Motors?

Contrary to popular understanding, slow speed motors will not automatically provide quiet operation; the exact opposite may be true.

Many fractional horsepower single phase motors in the lower speeds have an inherent magnetic hum or "growl" which sets up harmonics of a low frequency. New standards for smaller motor frame sizes are dictating the reduction in the amount of iron and copper in the motor. This, in turn, results in a greater amount of magnetic "growl" in the slow speed fractional horsepower single phase motors. However, it is much less difficult to isolate high frequency vibrations and noises than those of low frequency.

In order to isolate low frequency sounds and noises effectively, it is essential that the isolator have a low frequency. This would require a very long spring — a spring type isolator — or if some other type of isolator, it would have to allow a great deal of movement.

Isolators used on the rotating element of a power roof exhauster must have a certain amount of rigidity if they are not to allow mechanical striking between the close clearance parts of the rotating element and the housing. Therefore, it is practically impossible to isolate the low frequency magnetic hum in a power roof exhauster. Generally, it is better to utilize a smaller diameter wheel operating at a higher rpm—although not necessarily at a higher tip speed—than a larger wheel at a lower rpm.

There are a great number of items that can be done to assure a satisfactory installation. Some of these are:

1) Provide additional isolators between the housing of the exhauster and the building.

2) Be sure that the harmonics of the building are such that they do not synchronize with the harmonics of the power roof exhauster.

3) Utilize flexible electrical connections to the motor of the exhauster so that the deliberate flotation of the rotating element, which includes the motor, motor mountings, and wheel, is not transmitted into the building.

4) Place sound absorbent lining in the duct from the roof curb on which the exhauster is mounted into the first elbow in the duct system.

5) Do not connect ductwork directly to the power roof exhauster housing. If necessary, specify a fabric connection of other sound absorbent material between the metal parts of the power roof exhauster housing and the duct.

6) Evaluate the nature of the occupied space which would affect the noise level, and if a low noise level is required, specify acoustical materials to be installed within the space.

7) Do not specify low speed fractional horsepower single phase motors which have high inherent noise levels.

8) Install a sound baffle—which can be a simple piece of equipment—within the curb beneath the unit.

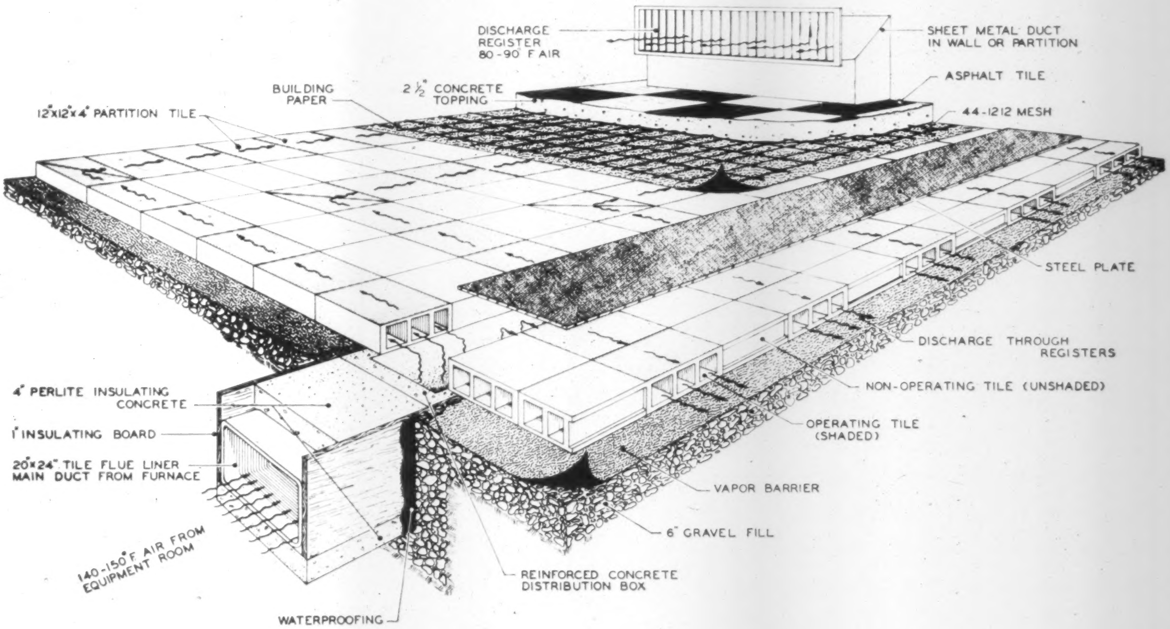
9) It may be helpful to install smaller power roof exhausters since the air noise caused by the movement of a large quantity of air through a single opening would create a higher noise level than the exhaust of an equal quantity of air through a number of smaller openings.

Are Belted Units a Solution?

Some engineers feel that belted units will automatically provide quiet installations. However, there is no assurance that a belted unit will solve the noise problem.

One advantage that a belted unit might have would be nearly all belted units use 1800 rpm motors and that a certain amount of isolation exists between the motor and the fan and shaft. This would also mean a smaller amount of magnetic hum due to the use of the higher speed motor.

However, it is known that if a belted unit is not structurally sound, it can be noisier than a direct connected unit. The reason for this is that more metal surface can vibrate. Also, the belted unit will have the noise of four ball bearings, whereas the noise of a direct connected unit is affected only by two ball bearings in the motor. ╪


DISCHARGE REGISTER 80-90 F AIR
SHEET METAL DUCT IN WALL OR PARTITION
ASPHALT TILE
BUILDING PAPER
2 ½" CONCRETE TOPPING
44-1212 MESH
12"x12"x4" PARTITION TILE
STEEL PLATE
DISCHARGE THROUGH REGISTERS
4" PERLITE INSULATING CONCRETE
NON-OPERATING TILE (UNSHADED)
1" INSULATING BOARD
OPERATING TILE (SHADED)
20"x24" TILE FLUE LINER MAIN DUCT FROM FURNACE
VAPOR BARRIER
6" GRAVEL FILL
140-150°F AIR FROM EQUIPMENT ROOM
REINFORCED CONCRETE DISTRIBUTION BOX
WATERPROOFING

FLOOR HEATING SYSTEM consisting of warm air supply ducts and triple cored blocks under the concrete slab radiates heat through the floor. Warm air is discharged into rooms through wall and window sill registers

Tile Blocks Radiate Heat Through Floors

. . . as warm air passes through blocks

THE NEW Fairmount temple, Beechwood Village, Cleveland, Ohio, has an unusual heating and ventilating system. Warm filtered air is forced from two heater rooms through underground feeder ducts and is discharged into clay tile blocks under the on-grade slab. These 12 × 12 × 4 in. blocks are placed end to end so that their interior distribution ducts line up across the rooms. After the warm air passes through the blocks radiating heat through the floors, it is discharged into the rooms at comfortable temperatures through wall and window sill registers.

Hot spots and drafts are reduced since some of the heat is expended through radiation, and because the air velocities and air temperatures from registers are low.

Another advantage is the constant air temperatures with little time lag.

To reduce heat transmission loss by 50 percent or even more, the design specified a 4 in. thickness of insulation over and under the 3400 lineal ft of main distribution duct and under some portions of the radiant heating tile blocks. ╪

Sam Lewis' Page

Troubles and Suggestions

Out of the author's long successful practice as a consulting engineer, here are a few practical suggestions for solving some troublesome problems he has met with in his experience.

• In an air conditioned public service company general office the executives wished to promote the sale of electric energy in winter. They hoped thereby to encourage winter sales by the reversed refrigerating cycle, employing a so-called heat pump. The refrigerating compressor required for summer was to be operated during the winter.

The condensing water was to be employed to warm the air of the ventilating system. This followed the proved idea that a watt of electric energy applied in running a refrigerating compressor would show via the warmed condensing water, something like three times as much heat as appears if the watt merely warms a conductor that resists the flow of energy.

Unfortunately, the refrigerating compressor had been designed for high summer efficiency so that the warmest condensing water obtainable was 85 F. They experienced little satisfaction trying to heat and to ventilate this large building with gently tepid water at an average circulating water temperature of 75 F.

My advice was to make sure that future heat pump projects for this company shall employ rather inefficient compressors that will heat the condenser water assuredly to somewhere near 120 F without developing noises and lubrication troubles.

• It is important that the automatic control valves on convectors which treat air from outside, and that the dampers which cut off the outside air, shall assume positive positions in case of failure of compressed air or electric energy. Very costly damage from frozen convectors has been experienced due to closed supply valves or to open dampers in emergencies of this type. Expansion and contraction of the ducts themselves has been proved to prevent the automatic closing of many a vitally important damper.

Automatic temperature regulating systems ought to "fail safe." If the actuating power to close a valve or damper in response to a thermostat should fail, then a spring or weight or some other scheme should permit the valve or the damper to assume a safe position, as to permit delivery of heat, or to shut off entry of freezing air.

• I would welcome more knowledge concerning antifreeze mixtures and a reduction in the cost of such compounds.

In one case a large piping system which had been perfectly tight for months with water, leaked badly and disastrously when a common automobile antifreeze solution was administered.

• Centrifugal refrigerating compressors have many admirable characteristics, especially along the line of flexibility and high efficiency under widely fluctuating loads. However, we need them in smaller sizes than the smallest now commercially available.

• Finned tube convectors, wonderfully efficient as they are, have, it seems to me, in the stress of competition, been made with too small tubes, thin metal fins too closely spaced and of fragile construction.

The interstices between tubes become clogged with dirt and the fins become bent and defeat their purpose. Rather than undergo the troubles which I have met from the clogged tiny tubes, the inability to drain out the water, and the high peaks and deep valleys of heat transmission rate, I would spend more money and would devote more space for less efficient convector surfaces of much thicker metal, holding much more water or steam or refrigerant.‡

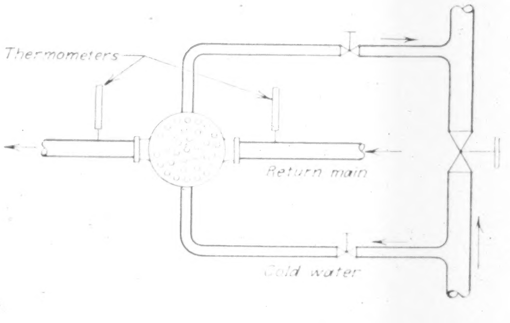
SAMUEL R. LEWIS, *consulting mechanical engineer and a member of HPAC's board of consulting and contributing editors, comments informally each month on practical heating, piping, and air conditioning problems.*

Air Conditioning, New Lighting Save Space

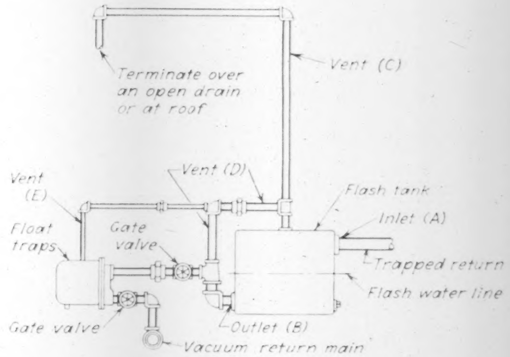
. . . in new office buildings

AIR CONDITIONING and fluorescent lighting have made it possible to construct office buildings with as much as 82 to 83 percent of the lot area being net rentable area, according to George Bailey, of the Chicago Board of Trade building, in a recent talk at the Union League club. With these two modern features, it is no longer necessary to incorporate courts or other space wasting architectural features.

Construction cost of an office building — with 9 ft ceilings — over the U.S. is about $30 per sq ft today. ‡



1 CONDENSATE COOLER, to condense any flash steam and to cool water for pump protection, shown here, consists of small heat exchanger connected into drip line



2 FLASH TANK must be used for condensate from kitchen steam equipment where pressures up to 50 psig may be used. The surplus steam is vented to the roof or another main

Having Trouble with Vacuum Pump?

. . . here's how to correct faulty installations and to achieve maximum efficiency

BY LEWIS SMITH
Dunham-Bush, Inc.

INCORRECT APPLICATIONS of vacuum pumps often deprive the owner of the full benefit of these pumps and give them an undeserved black eye.

Low Returns. A vacuum pump should never be used to lift the condensate out of a low return except by means of an accumulator tank. Also, lifts or lift fittings should be avoided except between the accumulator tank and the pump. All returns should flow to the tank by gravity.

Hot Returns. Vacuum pumps should be kept as cool as possible. If the vacuum switch is set in the usual manner to stop the pump at 8 in. Hg, then the water in the pump cannot be hotter than the boiling point at 8 in. Hg or 197 F. It should be cooler, at least down to 180 F, because the pump itself adds a little heat to the water. For this reason, it is always best to leave the return mains uncovered. The discharge temperature at the traps at 2 psig will be at least 200 F, and the bare return mains are necessary to provide cooling surface to reduce this to 180 F at the pump. It is a fact that some jobs can be improved by ripping the covering, if any, off the return lines.

If steam water heaters are used at from 5 to 10 psig, then the condensate from the trap will be 210 F or even higher. If the heater is near the pump, this hot condensate flashes into steam and overheats the pump. Such returns should go to a separate condensate pump. As an alternative, a small heat exchanger can be connected into the drip line, containing a coil through which part of the cold water going to the heater is passed, as shown in Fig. 1. This will condense any flash steam and cool the water down to the point where it will not affect the pump and may even help to cool it. Water heaters are available which contain a small coil built for the pur-

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This article has been adapted from a paper presented by the author at a recent NDHA meeting.

pose of cooling the condensate from the drip trap.

Where there is a kitchen with steam equipment, pressures up to 50 psig may be used. This condensate must be taken through a flash tank as shown in Fig. 2. The surplus steam is vented to the roof. Sometimes it is possible to save this steam by sending it into a main operating at a lower pressure or a vacuum, in which case there would be changes in the connections shown. It is assumed that all the kitchen equipment is properly trapped.

When the amount of condensate is small, a length of finned pipe can be used as cooling surface if there is room to install it, but in general the condensate cooler shown in Fig. 1 or cooling coil in the water heater is the best method.

Improper Water Heater Connections. Considerable trouble can be caused by improper connections from the water heater if the returns go to a vacuum pump. A float and thermostatic trap is always used as a drip trap. Some manufacturers of these heaters recommend and even insist on a vacuum breaker between their steam coil and the trap. They complain that the formation of a high vacuum which occurs when the thermostatic steam valve closes may cause noise and even some damage to the coil when the steam comes on again.

Very often a simple check valve is used, opening in to the coil but it is evident that this valve will allow air to be drawn into the vacuum pump a good deal of the time.

A vacuum breaker can be substituted and set so that it will open only when the vacuum at this point exceeds the setting of the vacuum switch on the pump.

Another idea is to use a float trap, without thermostatic bypass and an air valve to break the vacuum. In this case the air admitted will not pass through the drip trap to the pump.

Still another solution is to install an equalizer line around a float and thermostatic drip trap with check valve opening towards the heater coil.

Leaky Piping. Too many vacuum pumps run continuously because of pipe leaks. Many owners complain, "My pump never shuts off." This condition is inexcusable. It not only wastes electric power, wears out the pump, deprives the owner of the benefits of vacuum operation but also promotes corrosion in the return lines. Prevention is easy.

Practically all specifications today require a water pressure test of the piping. This test should be made after the job is completely installed but that is seldom possible. The test pressure is likely to be too high for cast iron radiators or convectors and for the traps. Furthermore, by the time the job is complete much or all of the piping may have been furred in so that leaks are hard to find and expensive to correct. Hence, it is customary to apply the water pressure to the mains and risers only, with all radiator branches capped and before drip traps are installed.

It is assumed that the radiators and traps will be hooked up without leaks. Unfortunately, that is not true. Fitters do fail to make up threads tight, they do leave hand tight union nuts and they do accidentally use fittings with sand holes in them. Leaks on the steam side will show up as soon as steam is turned on but not on the return side. The contractor starts the pump, the gage shows some vacuum and everyone thinks the job is done, overlooking the fact that the moment the pump is stopped the vacuum vanishes.

The only safe course, and the one which is being used more and more, is to run a vacuum tightness test on the completed job. A vacuum of 20 in. Hg should be pulled in a cold system with the boiler or steam supply valves off. Then the pump is stopped. The vacuum should not drop more than 3 in. in 2 hours. If it does, air pressure should be applied to locate leaks.

Many vacuum pumps can be reversed to act as compressors. Or some of the trap elements can be removed so as to put steam pressure in the returns. In either case, leaks can be detected by sound. They are practically never found in the pipes, only occasionally in fittings and threads and most often in unions.

In the case of an old job, a vacuum pump should not be recommended unless the piping, if concealed, is known to be reasonably tight, or is exposed so that it is easy to get at. It is bad to get an owner to install a vacuum pump and then find that the building has to be more or less torn apart to make the job even reasonably tight.

Intermittent Control Systems. When a control system is used which turns the steam on and off either by a time clock or a thermostat, every time the control valve closes, steam is trapped in the system. The condensation of this steam can quickly create a very high vacuum, much higher than the pump can pull. The result is that the water stays in the pump tank and may even back up into the mains which will cause water hammer when the steam is turned on again. The cure for this is a vacuum breaker set to open at a slightly higher vacuum than the pump switch is set for. This will keep the pump free of water at all times. ‡

The object of the Society is to advance the arts and sciences of heating, ventilating, cooling and air conditioning, and the allied arts and sciences, for the benefit of the general public, to encourage and conduct scientific research, and to cooperate with other organizations having the same or similar objectives.

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Heating, Piping & Air Conditioning

Journal Section

of the

AMERICAN SOCIETY OF HEATING AND AIR-CONDITIONING ENGINEERS

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SOCIETY COMMITTEE ORGANIZATION

General Committees: The By-Laws provide for 9 such committees. The latest list appears in the August 1957 issue on page 156

Research Committees: The research program is under the guidance of the Committee on Research — a General Committee. The Committee on Research appoints Technical Advisory Committees as needed. The listing appears in this issue on page 182

Special Committees: At present there are 9 of these committees. The latest list of them and of their personnel can be found in the August 1957 issue on page 156

Nominating Committee: This committee's membership is fixed by the By-Laws. The latest listing appears in the August 1957 issue on page 156

SOCIETY REGIONAL ORGANIZATION

The latest listing of the names of the Regional Directors and of the members of the Chapters Regional Committees appears in the April 1957 issue on page 176

SOCIETY CHAPTERS AND BRANCHES

The Society has chartered 69 Chapters, 1 Overseas Branch, and 6 Student Branches. These groups elect their officers and governing boards. A list of the presidents and secretaries appears in the July 1957 issue on pages 181-182

The President's Page

Society Growth Problems

The Society moves along in size following the pattern of the past 12 years. This summer we welcomed our 68th Chapter at Johnstown, Pa., and our 69th Chapter at Jacksonville, Fla., and the total membership will soon reach the 12,000 figure.

However, with growth and continually changing conditions, new situations develop and resulting problems must be resolved. Many of these problems are often of immediate urgency and become a part of the normal responsibilities of the Council and committees. Other problems, while not requiring immediate action, are of sufficient interest and importance to keep the Council alert and in an inquiring mood. One place to address inquiries is to the membership at large, for these questions are of direct interest to all members.

At present at least 3 question arising out of Society growth are receiving attention from the Officers, the Council and the appropriate committees, *viz.*: (1) What is to be done about COOPERATION with other Societies?; (2) What kind of material should be included in our Journal?; and (3) What about the arrangement of Programs at our MEETINGS?

Here now I am reviewing only the first of the subjects, but plan to do the same for the other 2, and perhaps others besides, on later President's Pages.

The Cooperation Problem

It is well established as Society policy that cooperation with other Societies and organizations interested in our work is desirable. In recent years, such cooperation has been worked out in differing ways. In the area of codes and standards, we have worked closely with the *American Standards Association* and the *National Fire Prevention Association;* on total engineering, we have recently joined the *Engineers Joint Council,* and we have exchanged program material with the *Air Pollution Control Association* and the *Instrument Society of America.* We now have a joint cooperation committee with The *American Institute of Architects* and the *American Institute of Electrical Engineers,* and recently have set up a similar joint committee on plant and animal husbandry as related to air conditioning with the *American Society of Agricultural Engineers.*

For years, the closest cooperative ties have been with the *American Society of Refrigerating Engineers,* and we have exchanged ideas on codes and standards, programs, joint meetings and other similar items. To strengthen and implement these cooperative efforts with the *ASRE* a joint committee of the 2 Societies has been in existence since 1954. Jointly-timed meetings of the 2 Societies, the ASHAE Semi-Annual Meeting and the *ASRE* Annual Meeting, are scheduled for June 1958, and a repeat summer joint meeting is now being talked about by the two Councils for 1960.

As of the present time, the Joint Cooperation Committee of the 2 Societies has been charged by the Councils of the 2 Societies to investigate the problem of merging the 2 Societies. As for the status of these studies, the joint committee met at Chicago in February of this year to *formulate* the plans for its investigative studies concerning a possible merger, and the committee is planning its second meeting during this very month to continue such studies. The responsibility of this committee is to determine the practicability of merging, and if practical, to develop a plan and then report to the respective Councils.

All will concede that there are many other ways in which we *might* cooperate with other Societies and organizations, but questions still unanswered are: In just what ways and just how far?

This matter of Society cooperation is but one of the questions which confront a growing Society in its efforts to improve existing services, provide new services where needed, and drop antiquated services and ideas when they are no longer necessary or adequate.

P. B. Gordon
President
American Society of Heating and Air-Conditioning Engineers

Techniques of Sound-Power-Level of Unitary Equipment

By

R. N. Hamme

The author is with Geiger & Hamme, Consultants in Acoustics, Ann Arbor, Mich. The presentation was made at the Symposium on Sound and Vibration at the Semi-Annual Meeting of the AMERICAN SOCIETY OF HEATING AND AIR-CONDITIONING ENGINEERS, Murray Bay, Que., Canada, June 26, 1957.

THERE is no longer any need to emphasize the importance of sound-power-level measurements in the technology of comparing and predicting machinery noise levels in different environments. The advantage of power-level over pressure-level specification is widely appreciated.

The conceptually straightforward method of measuring sound-power-levels involves the integration of sound-pressure-levels over an imaginary surface enclosing the noise source, with the assumption that none of these sound-pressure-levels are influenced by sound coming anywhere other than directly from the noise source. In other words, an acoustic free-field is the required measurement environment. Attention can be confined to indoor free-fields, because the rain and wind and temperature variation leave a great deal to be desired outdoors, even if a free-field can be located which is free both of reflecting surfaces and extraneous noises. Restricted thusly, one can define unitary equipment in very general terms to be any element or complex of machinery that can be introduced discretely into a room and maintained there in a steady-state running condition. Fig. 1 collects a number of suggestions for this meaning of unitary equipment.

In the discussion that follows concern will be directed to the properties of the room in which power measurements are to be undertaken. No attempt will be made to lay out a detailed comparison between free-field or anechoic-chamber methods with other power measurement techniques, but rather the tacit thesis will be taken that good anechoic environments are expensive and difficult to maintain, that numerical integration of a microphone survey is a process that is abhorrent to most men and complicated to do mechanically, and that the directional characteristics of a noise source are not always important enough to justify their careful determination, especially when ultimate use of unitary equipment is rarely restricted to anechoic environments. This is not meant to be a tirade against any particular acoustic environment or measurement technique, but rather a practical facing-up to the facts of life for people who like to stay indoors but not work too hard on a single sound-power-level determination.

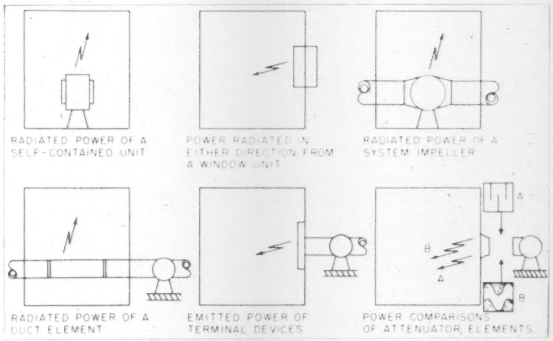

RADIATED POWER OF A SELF-CONTAINED UNIT
POWER RADIATED IN EITHER DIRECTION FROM A WINDOW UNIT
RADIATED POWER OF A SYSTEM IMPELLER
RADIATED POWER OF A DUCT ELEMENT
EMITTED POWER OF TERMINAL DEVICES
A
B
B
A
B
POWER COMPARISONS OF ATTENUATOR ELEMENTS

Fig. 1 — Unitary equipment — contrived definitions

Without extensive precautions, sound reflected back from the boundaries of an enclosure is bound to influence sound measurements made at practical distances from the source in the interesting range of frequencies. The long wavelength of sound and the low absorptivity of practical materials at low frequencies conspire together against the economics of anechoic chambers. Except in very large rooms, in order to get far enough from the source, one gets too close to the walls, and vice versa. What then are the possibilities of deducing sound power information from measurements that are influenced by the room boundaries and possibly exploiting the influence of the boundaries to relieve the tedium of numerous measurements? A fairly complicated argument leads to a remarkably simple and useful result.

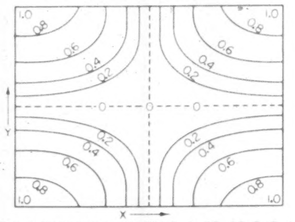
Any enclosed volume of air will exhibit pronounced variations in its response to localized excitation by a steady sound source. Sound pressure variations will be noted both as the frequency is changed and as the microphone and source positions are changed relative to the boundaries. These changes are due in great part to purely geometrical factors involved in the successive reflections of sound from the boundary surfaces. Consequently, any single microphone reading at a particular frequency will yield very little insight, indeed, into the sound power output of the source at that frequency, even if the source be a non-directional point source.

Consider a rectangular enclosure, for example: a typical room. In the manner of the closed organ pipe of elementary physics, the enclosed volume of air will exhibit resonance frequencies whenever the half-wavelength of sound approaches an integral submultiple of the distance between opposite walls, for under these circumstances reflected trains of waves progress in phase to produce a standing wave pattern. Under these circumstances there will be alternate planes of minimum and maximum sound pressure running parallel to the interacting opposite walls, but these represent only the simplest standing wave patterns. The geometry of the situation also permits setting up standing waves in any number of diagonal interactions between walls at angles of incidence that are different from normal, so that enormously complicated standing wave patterns are possible at an indefinite number of closely spaced frequencies. The equation that predicts the frequencies of all of the normal modes of a rectangular room is shown in Fig. 2, together with the relative sound pressure floor-plan of one of the simplest standing wave patterns[1]. A number of considerations arise from this situation with regard to the sound power measurement of a blower-noise tone, for example.

From Fig. 2 it is evident that along a frequency axis there is a triple infinitude of natural frequencies, the density of which, per octave for example, increases with increasing frequency. Furthermore, it is evident from the sound pressure floor-plans that the complexity of the standing wave patterns increases so that the adjacent minima and maxima get closer together as frequency increases. The dimensions of the room will determine the frequency of the lowest mode, as well as the density of the natural frequencies clustered about any given frequency. If, then, attention is focussed on frequencies low enough in a room of given size, a frequency region is found in which the normal modes are relatively isolated frequency-wise, and for which the maxima and minima in the standing waves occupy large room volumes. Consider how the sound pressures measured throughout a room under these circumstances might be related to the sound power output of the source.

$$f_n = \frac{C}{2}\sqrt{\left(\frac{n_x}{l_x}\right)^2 + \left(\frac{n_y}{l_y}\right)^2 + \left(\frac{n_z}{l_z}\right)^2}$$

WHERE f_n = n^{th} NORMAL FREQUENCY IN CPS
n_i = 3 INDEPENDENT SETS OF INTEGERS TAKING ALL VALUES FROM 0 TO ∞
l_i = DIMENSIONS OF THE ROOM
C = SPEED OF SOUND



RELATIVE SOUND PRESSURE CONTOUR PLOT OF THE (1,1,0) NORMAL MODE OF A RECTANGULAR ROOM

Fig. 2 — Resonance of rectangular room[1]

Obviously, the sound pressure at any single microphone location will have no significance without a complete knowledge of the normal mode distribution at the frequency of the tone under consideration, be it that of a pure-tone loudspeaker or a single predominant component in the noise spectrum of a piece of unitary equipment. A method must be postulated for surveying with the microphone to obtain the root-mean-square magnitude averaged both in space and time, to which one will always tacitly refer henceforth when speaking of the sound pressure of a normal mode. In these terms, how is the sound pressure of a normal mode related to the sound power of the source exciting this mode?

The space-averaged sound pressure of a normal mode excited by a component of the same frequency can be shown to be proportional to the source strength and inversely proportional to the room absorption only for a given source location in a room of given volume[2]. If the source is located at a position of minimum sound pressure in the pattern of the normal mode, it is found to excite the mode to a lesser extent than it would if located at a point of maximum sound pressure. For example, since all but one-eighth of the total number of normal modes in a rectangular enclosure have a locus of zero pressure passing through the center of the room, a variable-frequency source located there will fail to excite seven-eighths of all possible normal modes, whereas a corner location for the source would have excited them all[1]. At low frequencies where normal modes have zeros that are comparable in size with practical noise sources, the pressure of a mode may fail to build up to a value that would fairly indicate the source strength. Furthermore, an isolated normal mode is excited in accordance with the usual resonance curve wherein the pressure of a mode passes through a peak value as the exciting frequency passes the natural frequency of the mode, the sharpness of the peak depending on the room absorption involved in the mode's reflections. Hence, if the frequency of excitation differs from the frequency of a normal mode, the build-up of sound pressure will depend on this frequency difference as well as the source strength. At this point, then, depending somewhat on the character of the noise band under scrutiny, these wave-acoustic considerations demonstrate a possible dependence of the sound-pressure-levels measured in a room upon several variables in addition to source strength and room absorption; viz., method of averaging, source location, and density of normal modes in the frequency range involved. These will pose limitations on the measurement method now to be developed on the basis of energy considerations without reference to frequency.

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[1] Exponent numerals refer to References.

$$PWL = SPL\rfloor_{RR} + 10\ LOG_{10}\,R - 6.0^{*}$$

WHERE PWL = SOUND-POWER-LEVEL OF SOURCE IN DB RE 10^{-13} WATTS

$SPL\rfloor_{RR}$ = SPACE-AVERAGED SOUND-PRESSURE-LEVEL IN THE REVERBERANT FIELD IN DB RE 0.0002 DYNES/CM^2

R = ROOM CONSTANT = $\dfrac{S\bar{\alpha}}{1-\bar{\alpha}}$

WHERE S = TOTAL SURFACE AREA OF ROOM

$$S\bar{\alpha} = \sum_i \alpha_i S_i + A_i$$

WHERE α_i = RANDOM-INCIDENCE ABSORPTION COEFFICIENT OF THE AREA S_i

A_i = ABSORPTION OF ROOM CONTENTS, INCLUDING AIR ABSORPTION

* (PLUS $[10\ LOG_{10}\,\rho c - 15.7] \cong 0$)

Fig. 3 — Sound-power-level from reverberant field measurements

There is a simple theory of sound-power-level measurement associated with what are called *large* rooms and *diffuse* fields. The room must be large in order to prevent its reacting on the source and modifying its sound power output, and the field must be diffuse in order to circumvent, among others, the wave-acoustic limitations described above. Allowable room size is defined in terms of the wavelength of sound, and so constitutes another form of low-frequency limitation for a given room. To be usable at a given frequency the mean free acoustic path of the room must be *several* wavelengths long, the mean free path being defined as 4 times the ratio between the total room volume and the total room surface area. For the field to be diffuse, all angles of incidence must be equally probable at all points on each boundary surface and all directions of sound wave travel equally probable at each point throughout the reverberant portion of the sound field[1].

These conditions being satisfied, it can be shown that the space-averaged sound pressure of the reverberant field is directly proportional to the total power emitted by the source and inversely proportional to the average absorptive properties of the room surfaces. This follows directly from the equilibrium condition that the energy be supplied at the same rate as it is absorbed.

In its simplest form, the quantitative relationship is shown in Fig. 3, applicable, strictly speaking, only to the reverberant field of a non-directional point source[3]. The sound-power-level of the source, PWL, in decibels relative to 10^{-13} watts, is 6 db less than the space-averaged reverberant sound-pressure-level, SPL, in decibels relative to 0.0002 dynes per square centimeter, as modified by the logarithm of the room constant, *R*. The room constant is defined as shown in terms of the total surface area of the room, *S*, and the average absorption coefficient of the surfaces, α. The average coefficient for the room is a weighted average of the actual random-incidence absorption coefficients, α_i, of the respective room surface areas, S_i. Inasmuch as the diffuseness requirement dictates in practice that all absorption coefficients, α_i, be small compared to unity, it is evident from its definition that the room constant can be regarded to be numerically equal to the total absorption of the room in this application, and therefore can be deduced directly from the Sabine formula and the reverberation time of the room; *i.e.*,

$$R \cong \text{total absorption} = 0.05V/T$$

where

V = the room volume.
T = the 60-db reverberation time of the room.

Needless to say, the room absorption is bound to be a marked function of the frequency unless purposely adjusted to be constant.

The practical meaning and use of this sound-power-level relationship is made clear by reference to Fig. 4. Here, the relative sound-pressure-level averaged locally in an enclosure is plotted against distance from a non-directional point source for rooms of varying room constant. For the case of infinite room constant (open air or anechoic chamber) the 6-db drop of sound pressure per doubling of distance from the source persists to any distance. As the room absorption decreases, however, the reflections build a reverberant field and departures from free-field sound pressure begin to occur closer and closer to the source, the lower the total absorption. In live rooms, the *constant* reverberant level dominates the picture until the 50-sabin room produces a constant reverberant level at all distances beyond 3 ft from the source. This constant level to which the reverberant field converges with suitable averaging is the sound-pressure-level from which the sound power can be deduced directly according to the foregoing equation. An important point to observe from Fig. 4 is that for any room of given size, the sound-pressure-level converges to the required reverberant value over a spatially more extended region for rooms of lower total absorption, thereby giving more space in which to perform the required averaging of microphone readings.

The restrictions just stated on the applicability of the sound-power-level equation can be relaxed quite considerably. That the source be a point is unimportant except in deducing the free-field portions of the curves shown, which is a region of no interest in the method being considered. That the source be non-directional is also of no importance in the proper use of live rooms, because at sufficient distance from the source the pressure level converges to the same reverberant value regardless of the directivity factor of the source[1]. An additional term involving the characteristic impedance of the air was omitted in stating the equation above because it is a negligible fraction of a decibel at normal temperatures and pressures. Specific mention of air absorption was minimized because its influence, limited to high frequencies, is taken into account by reverberation-time determinations of the room absorption.

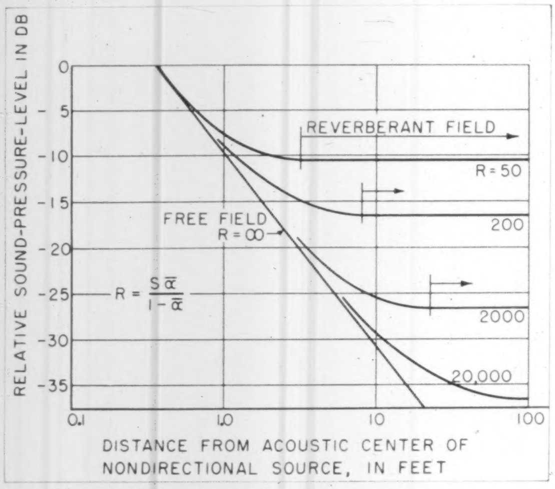
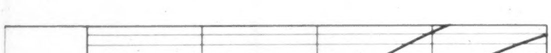


Fig. 4 — Extent of reverberant field[1,3]

The restrictions remaining on the use of the sound-power-level equation have to do essentially with the low frequency limitations imposed by wave-acoustic considerations discussed earlier. At all frequencies of measurement there must be assurance that pressure averaging be confined to the reverberant portion of the field, that averaging is extensive enough to encompass the full span between pressure minima and maxima, that at least one normal mode is fully excited by the source, and that incidence upon all surfaces is suitably random in direction. Low room absorption, required already to maximize the extent of the reverberant field, especially with respect to directional sound sources, will also increase diffusion by maintaining the relative importance of the more complex multiply-reflected modes. For broadband noise sources and a relatively wide frequency band of measurement, the simultaneous excitation and superposition of numerous normal modes ensure diffusion at all frequencies where a sufficient number of normal modes are included in the measurement band. Fig. 5 shows the typical dependence of the number of modes per fractional octave on band mid-frequency and room volume[4]. Irregularity of room surfaces will increase the number of modes per unit bandwidth and thereby reduce the extent and tedium of a brute-force microphone survey[1]. But the extension of a room's usefulness to low frequencies with noise spectra that involve prominent discrete components would appear to depend upon techniques of mechanical diffusion that would continuously sweep the normal-mode structure of the room across the source location in order to ensure the full excitation of a sparse natural-frequency distribution. The mechanics of such a facility will be described briefly.*



MULTIPLY NUMBER OF MODES BY:
1.5 FOR 1/2-OCTAVE BANDS
3.96 FOR OCTAVE BANDS

Fig. 5 — Density of normal modes in rooms of ordinary shape[4]

A 5000-cu-ft chamber, purported by Fig. 5 to possess more than 20 normal modes per third-octave band down to 100 cps, and with a mean free path of about 10 ft, is massively constructed with a hard plaster interior to minimize absorption. At 125 cps this chamber is *large* (mean free path exceeds wavelength), has a rich modal structure (exceeding the 30 mode per third-octave criterion)[5], and very low absorption (less than 20 sabins). At this frequency, however, decay-time determinations are not highly reproducible without a plus-or-minus 15 percent warble of the exciting tone plus mechanical diffusion afforded by the 12-rpm rotation of an 8- by 16-ft rotating reflector vane. Although this is an exacting criterion, this is presumed to indicate that continuous movement of a reflecting surface is required to extend diffuse conditions to lower-frequency narrowband measurements, but this represents little inconvenience when the consequent simplification of the space-averaging procedure is also taken into account. Consider the following averaging procedure.

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*Reverberation chambers (a) at the Engineering Research Institute, University of Michigan; and (b) at Geiger & Hamme Laboratories; both at Ann Arbor, Mich.

With the source of noise fixed in location and running in its steady-state condition, a broad-band tape recording at a single fixed microphone position contains all of the information necessary from which to deduce at leisure a sound power spectrum of any desired detail. If a tape loop is formed which represents the noise recorded over a number of complete cycles of rotation of the reflector vane, the time-averaged band-pressure level obtained by repetitive play-back of the tape loop through a bandpass filter represents the space-averaged reverberant sound-pressure-level of the source in this frequency band. Knowing the room absorption in this band of frequencies yields the sound power level of the source in the band. If the tape loop is played back repetitively into a slow-scanning narrowband analyzer synchronized with a chart recorder, the discrete-frequency sound-power-level spectrum of the noise source can be read off the chart directly using a template of the room-absorption characteristic as a baseline. The elegance of the method evolves from the conversion of a tedious space-averaging problem into a routine and automatic time-averaging process, thereby releasing the measurement facility after a few minutes' use and relieving the necessity of maintaining the noise source in a steady-state condition for a long period of time. This can substantially reduce the complexity of a test setup.

The method described involves considerable facility investment, but certainly not more than that required by a comparable anechoic-chamber method. The directions are clear in which to proceed in simplifying the method to routine broadband measurements of lower precision, but the restrictions on the method have been emphasized purposely in order to warn against the pitfalls associated with a casual selection of room environment and measurement procedure.

References

1. *Acoustics*, by L. L. Beranek (McGraw-Hill Book Co., Inc., New York, 1954, Chapter X).

2. Analysis of Sound Decay in Rectangular Rooms, by F. V. Hunt, L. L. Beranek and D. Y. Maa (*Journal Acoustical Society of America*, Vol. 11, 1939, pp. 80-94).

3. *Handbook of Acoustic Noise Control*, Vol. 1 — Physical Acoustics, Ed. R. H. Bolt et al (Bolt, Beranek and Newman, Inc., December 1952. Wright Air Development Center Technical Report No. 52-204).

4. A Sound Power Experiment, by R. W. Young (Unpublished Technical Memorandum No. 225, Naval Electronics Laboratory, San Diego, Calif., December 12, 1956).

5. Draft of American Standard for Objective Measurement of Sound and Acoustic Power Level (*American Standards Association*, Writing Group Z24-W25, F. M. Wiener, Chairman, December 1, 1955).

REGULATION OF REFRIGERATING EFFECT

Copy of a bulletin under the above title was recently received from the Engineering Section of the *Commonwealth Scientific and Industrial Research Organization* of the Commonwealth of Australia. The bulletin is a reprint of an article from the *Journal of The Institution of Engineers*, Australia.

The paper deals with the theory and application of a method of refrigerating effect regulation, suggested in the *Danfoss Journal* in 1952, which uses a direct expansion evaporator as a final cooling element and which maintains approximately constant temperature of evaporation irrespective of load.

It was first applied to and tested on a special laboratory air conditioner, recently developed by *CSIRO*, and was later used successfully in research applications.

Although these applications are all concerned with high accuracy temperature and humidity control, it is felt that the method may be used in other applications because of its simplicity and relatively low first costs, and because it can be easily adopted in existing plants. It could be called a bypass-injection method, as it is essentially based on bypassing the condenser and evaporator and injecting liquid refrigerant into the suction line.

The bulletin analyzes the theory of the bypass-injection method and describes some tests made in various field applications. It is indicated that the tests showed that the amount by which the pressure and temperature decrease at partial load is chiefly a function of the characteristic of the reducing valve. A high-lift valve having a low spring constant and sized to handle approximately 80 percent of refrigerant gas leaving the compressor was found to give the least variations in evaporation conditions. In the equipment tested a ¾-in. diameter valve was used.

Conclusions arrived at as a result of the analyses and tests described in the bulletin are as follows: (1) the temperature of evaporation can be kept practically constant with the method discussed; (2) the only equipment required, not normally included in a refrigeration system, is a reducing valve (of special type) and an additional TXV; (3) it can be easily added to existing refrigeration plants by running short connections between hot gas line and suction line, and between liquid line and suction line; these can be located in the condensing unit area; (4) the advantages of the regulation of refrigerating effect at constant evaporation temperatures are most evident in direct systems for close control of air temperature and especially humidity, in which the cooling load is variable; (5) the running costs at partial loads are slightly higher than the part-load running costs of a simple system.

The article is the work of J. J. Kowalczewski, who is senior research officer, Engineering Section, *Commonwealth Scientific and Industrial Research Organization.*

Sound Standards for Testing and Rating

By

H. C. Hardy

The author is Consultant in Acoustics, Chicago, Ill. The presentation was made at the Symposium on Sound and Vibration at the Semi-Annual Meeting of the AMERICAN SOCIETY OF HEATING AND AIR-CONDITIONING ENGINEERS, Murray Bay, Que., Canada, June 26, 1957.

THE SOCIETY is about to engage in a program of acoustical standardization. Before doing so, it wisely engaged in a research program at its Laboratory to get a large amount of the background data necessary to embark intelligently on this program. Most of the research, as presented by W. F. Kerka[1], was directed toward comparing systems for measuring sound power of fans. One of these systems is about to be chosen for not only fans but for many types of related devices which also make noise. Thereby will be set up a whole complex of technological ideas with which this Society will be working for many years to come.

There is hardly a product in the heating and air-conditioning industry which does not have some physical parameters which have noise ramifications and many require noise measurement. Among the components whose noise characteristics might need to be evaluated are: (1) fans; (2) air intake and outlet openings and diffusers; (3) regulators of pressure and flow; (4) central heating units; (5) package heating units; (6) central air-conditioning units; (7) cooling towers; (8) room air conditioners; (9) heat pumps; (10) a large number of liquid movement systems and components such as: *a.* pumps, *b.* valves, *c.* drains, *d.* pipes with high-velocity flow.

Most of these will require measurement under many conditions of operation. Since this is a task which is going to consume many man-years of laboratory effort, it is wise to be rather deliberate about these decisions.

Criteria of a Good Standard

The criteria for a good measurement standard are, the author believes, as follows:

1. It must be useful.
2. It must be understood.
3. The measurements it describes should be capable of being carried out with facilities readily available to the average manufacturer.
4. Tests should require a minimum of setup and calibration time.
5. There should be a reference laboratory for primary standards.
6. There should be consistency of results among different laboratories.
7. The results should be scientifically accurate.

There are too many standards filling up files and which are not useful or understood, often because they are too complicated to be practical. Most mechanical engineers consider acoustics a complex subject, and any noise measurement standard must be made as simple as possible. It will be noticed that scientific accuracy has been placed last on this list, and deliberately so. This is not to say that accuracy is not important. Many times what is most wanted, however, is only a proper and precise rank order consistent with a reasonable amount of accuracy. To increase slavishly the accuracy at the expense of usefulness and simplicity is not to be recommended, especially in acoustical standards.

Special Considerations Pertinent to Noise Measurements

Acoustical measurements, especially those pertaining to noise, do not require the accuracy which is usually associated with mechanical and electrical measurements. Acoustical phenomena exist over a large range of intensity of at least one million million to one, but the sensitivity of the ear to small changes is not great. Use is therefore made of the foreshortening effect of a logarithmic scale and sound level meters are calibrated in decibels.

As a rule it is not necessary to obtain data to a greater precision than 1 db, which is about 20 percent change in power output. This is fortunate because one cannot generally measure acoustic power directly and must fall back on a sound-pressure-level measurement. Only the most precise electronic equipment will enable measurement closer than 1 db and then the variations due to the geometry of the measurement space, the energy distribution in different directions, the statistical fluctuations from moment to moment during operation, and other variables such as air motion in the atmosphere, temperature, and humidity also limit the precision.

It is true that one can often read the meter to closer than 1 db, but reporting such data as meaningful is as foolish as the procedure of the college freshman who computes the volume of a barrel by using π to 6 significant figures.

More important than the precision of magnitude is the distribution of energy in various frequency bands. One needs to know this frequency distribution so that he can: (1) calculate approximate subjective reactions, the ear being much more sensitive at higher frequencies; (2) compare the sound with the background noise, which often has a much different distribution from that of the device being evaluated; and (3) make economical engineering corrections (low-frequency noise control is usually more expensive than high frequency control). It is fortunate that the noises of interest to the members of this Society can nearly all be adequately analyzed with a rather inexpensive instrument, the octave band analyzer. Since this instrument, and the sound level meter with which it is associated, have already been standardized for noise measurement[2], any noise standard that this Society formulates in the near future will be based on measurements with these 2 instruments.

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[1] Exponent numerals refer to References.

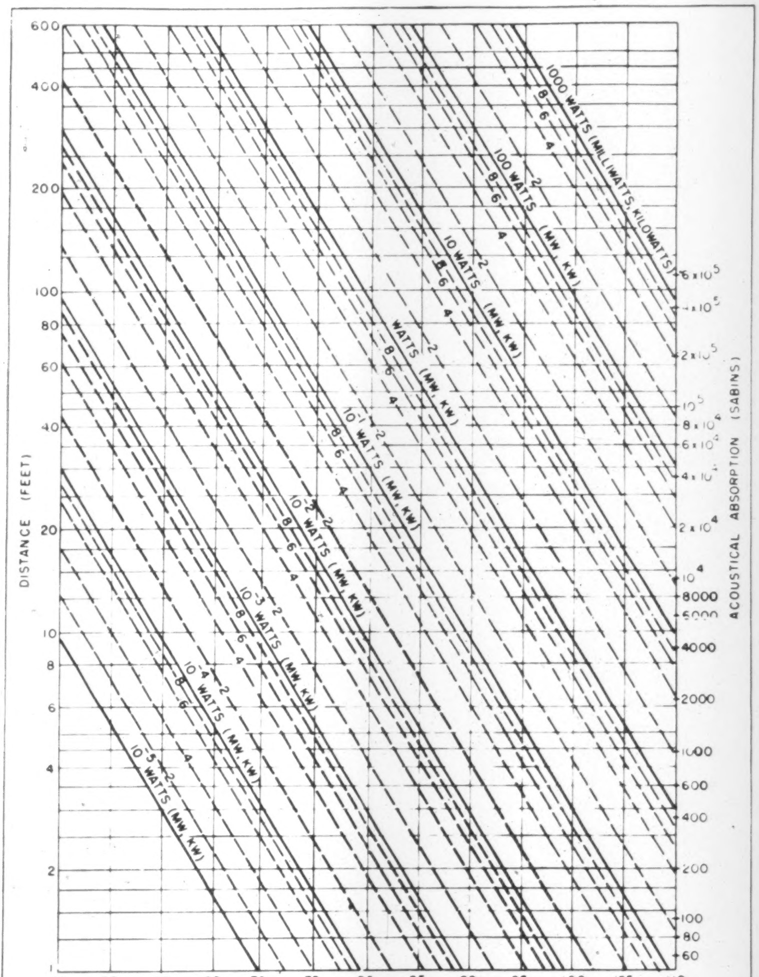


Fig. 1 — Chart for determining sound-pressure-levels from total acoustic power

The next question is, how should such data be presented. The recorded data will generally be sound-pressure-levels, that is, decibel readings for octave-frequency bands. From this will be computed a sound power by one of several methods to be discussed in a moment. Since the start is made with logarithmic data in decibels, some individuals, mostly acoustical scientists, would have the calculation keep to the logarithmic form, converting all other data to decibel units. This involves taking the logarithms of areas, distances, absorption units, and numbers such as the number of radiating sources. The numerical calculation then becomes simply a matter of subtracting or adding decibels to get the required answer. It is convenient in this method to refer to power in terms of power level, which is the number of decibels the power is, related to an arbitrary threshold. Thresholds of 1 watt, 1 milliwatt, 1 microwatt, 1 micro-microwatt, and 10^{-13} watts have been suggested, and the latter reference has the most users.

There is considerable danger of confusion if this scheme is used, however. For one thing, there will have to be at least 2 kinds of decibels (a recent suggestion of a new kind of notation identified 21 kinds of decibels, and it appears that a few were overlooked). It would be better if this industry would use the term decibel only for the reading of a sound level meter, and report power in watts, milliwatts, or microwatts, whichever is most suitable.

As an example consider a problem of a roof ventilator emitting 0.1 watt in the 150-300 cps band. What would be the sound-pressure-level in this band at a residence 300 ft away.

The equation which applies is

$$P = [p^2/(\rho c \times 10^7)]\ 4\pi r^2 \quad ..(1)$$

where

P = the power emitted in watts.
p = sound pressure in dynes per square centimeter.
ρc = the density of air times the velocity of sound (in air $\rho c = 41.7$ cgs units).
r = the distance in cm (to convert r^2 from sq ft to sq centimeters multiply by 929).

Reduced to decibel notation this can be written,

$$\text{SPL} = \text{PL} - 20 \log r - 10.5 \quad ..(2)$$

where

PL = power level in decibels.
r = in feet.

The solution to the foregoing problem is as follows (0.1 watt equals a PL of 120 db):

$$\text{SPL} = 120 - 49.5 - 10.5 = 60$$

One can keep the arithmetical notation and get the same results. In this case, the simplified equations are

$$p^2 = (3.6\ P \times 10^4)/r^2 \ \ldots\ldots (3)$$

$$\text{SPL} = 10 \log p^2 + 74 \ \ldots\ldots (4)$$

Substituting the values just given

$$p^2 = 0.04$$

$$\text{SPL} = 60$$

One advantage of the second system is that values of p^2 from many sources can be added up before using Equation 4 for the total of the sum of all the p^2 values.

Still another method would be graphically such as that given in Fig. 1. Following the horizontal line for 300 ft to where it intersects the diagonal 0.1 watt line, the abscissa is seen to read 60 db.

Another example would be for an internal noise problem. Suppose there are 4 unit heaters in a warehouse, each contributing 2 milliwatts in the 300-600 cps band. What is the sound-pressure-level in this area? The equation which applies for the sum of all the sound power emitted is

$$P = [p^2/(4\rho c \times 10^7)]\ A \ \ldots (5)$$

with the same notation as before, and A equals the total absorption in the room in cgs units. To convert the American standard unit absorption, the sabin, to cgs units, one multiplies by 929. Reduced to decibel notation, Equation 5 becomes

$$\text{SPL} = \text{logsum (PL)} - 10 \log A + 6.5 \ \ldots\ldots (6)$$

The logarithmic sum of the power level of the sources may be a rather complicated function. For the problem being considered, 2 mw is a power level of 103 db. Four units give 10 log 4 or 6 db more. 10 log $A = 37.8$, so that

$$\text{SPL} = 103 + 6 - 37.8 + 6.5 = 78 \text{ db}$$

The arithmetic calculation would be as follows:

$$p^2 = (1.8\ P \times 10^6)/A \ \ldots\ldots (7)$$

which numerically gives

$$p^2 = (1.8 \times 0.008 \times 10^6)/6000 = 2.4$$

$$\text{SPL} = 10 \log p^2 + 74 = 78 \text{ db, as before.}$$

One can see that the amount of mathematics is about alike with a preference for the arithmetic calculation when there is more than one source, which is often the case. It is recommended, therefore, that for the immediate future both sound power and sound-power-level data be presented for each noise source. This can be easily done graphically by use of 2 ordinate scales. Time will show which of these systems is the most used.

Recommended Sound Calibration Scheme

It would be an advantage in simplicity if one system of measurement, evaluation, and presentation could be applied to most of the different devices manufactured in the industry served by this Society. This, however, may be a sheer impossibility. It may not be possible to stretch a simple technique of measurement to be applicable, for example, to both room fans and large steam boilers. However, it appears that one of the 4 schemes suggested will be convenient for most noise calibrations.

The 4 schemes suggested are:

1. Free-field, which is either outdoors or in a specially constructed anechoic (echoless) chamber.
2. Random incidence field or reverberation room measurements requiring a comparatively live room.

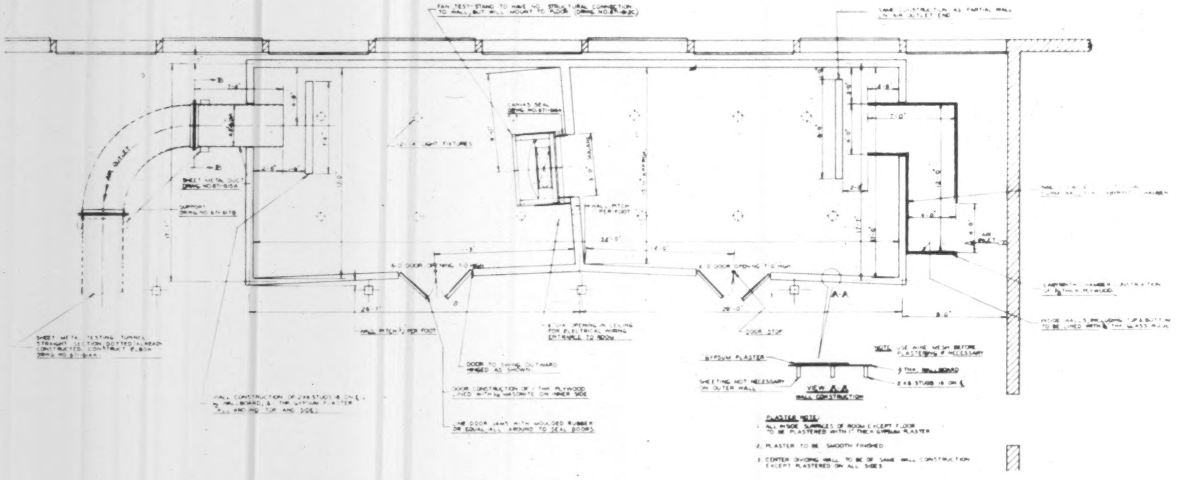

A-A
DOOR STOP
GYPSUM PLASTER
SHEETING NOT NECESSARY ON OUTER WALL
VIEW A-A
WALL CONSTRUCTION
NOTE: USE WIRE MESH BEFORE PLASTERING IF NECESSARY
2 x 6 STUDS 16 ON ℄
PLASTER NOTE:
1. ALL INSIDE SURFACES OF ROOM EXCEPT FLOOR TO BE PLASTERED WITH 1" THICK GYPSUM PLASTER
2. PLASTER TO BE SMOOTH FINISHED
3. CENTER DIVIDING WALL TO BE OF SAME WALL CONSTRUCTION EXCEPT PLASTERED ON ALL SIDES

Fig. 2 — Plan view of one company's noise evaluation reverberation test rooms

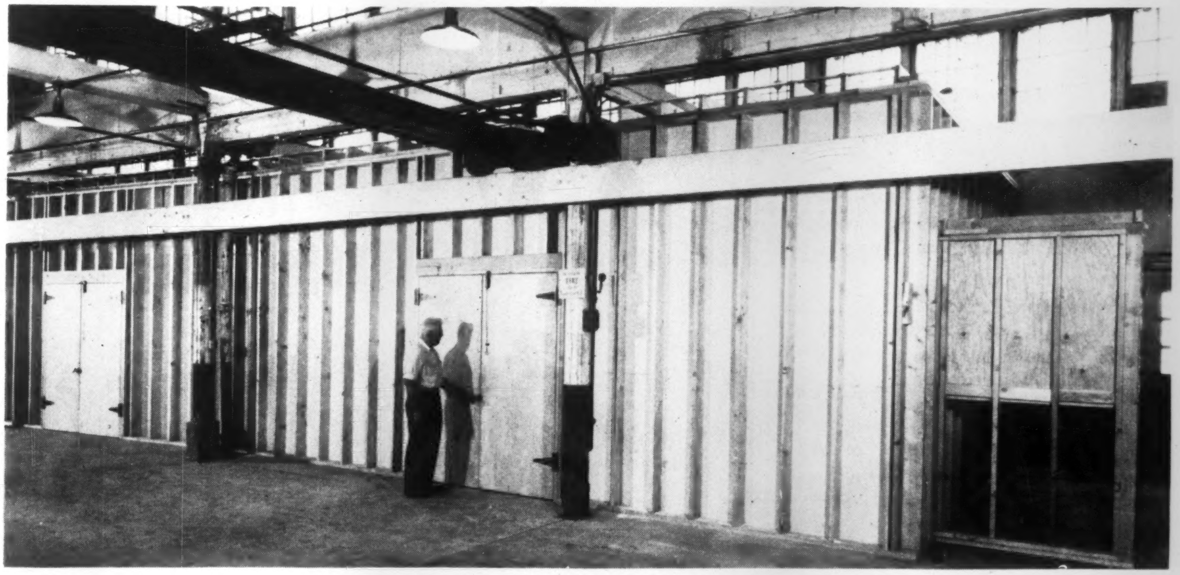


Fig. 3 — Exterior view air inlet end of noise evaluation reverberation test rooms of Fig. 2

3. Duct measurements, which would probably only be used for duct-connected fans.

4. Sound traverse of the cross-section of a duct or other sound radiating area. This would be useful in only a few applications.

Of these the most advantageous by far is the random incidence (or reverberant) field measurement. This method was described in some detail in a previous paper[3]. Its advantages are:

1. *Measurement space is usually readily available.* Most any reasonably live room on the order of 4000 cu ft will be adequate. This room can have other uses.

2. *Standard noise sources can be used for comparison.* This means that neither the electronic equipment nor the room characteristics need be accurately calibrated.

3. *Data would be taken at only one measurement point.* Because of the even distribution of sound, all measurement points will give essentially the same data. At the lowest frequencies, where the acoustical field is less random, an average of several positions may be advantageous depending on the accuracy required.

4. *The results are not affected by the presence of other mechanical objects or personnel in the room.* This is, provided the large objects are at least a few feet from the source and the microphone.

5. *The orientation of the source is only of minor importance.* The exceptions to this are when the noise source has a particular geometrical relation to its surroundings as, for instance, a grille in a wall, which should be measured when mounted in a wall.

The most important disadvantage of this scheme is that no information is obtained about the radiation

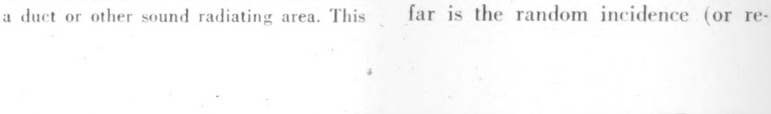


Fig. 4 — Interior view of air outlet side of noise evaluation reverberation test room with power-flow roof ventilator on test. Sound level meter microphone in position. Octave band analyzer not in photograph

pattern. There may be some applications where this knowledge is important; however, the most fundamental quantity for an acoustic standard is the total acoustic power. The measurement of radiation patterns is a more sophisticated procedure and might be the subject of a future measurement standard, after the power measurements are more universally used.

Details of the Random Incidence Measurement Scheme

The remainder of this paper will describe the random incidence (reverberant) field technique of measurement. A good example of such a laboratory is the first one to be set up as an industrial facility of this kind for measuring fans. A pair of reverberant rooms of simple construction were built in a larger plant area. A plan view of these rooms is shown in Fig. 2.

This arrangement enables one to measure both the intake and exhaust noise of a roof ventilator at the same time. The air comes in the intake at the right and passes out at the left through a piping system which can be used to measure flow. The walls and ceiling of the room are slightly skewed to break up the most prominent standing waves. A view of the exterior of the building on the intake side is shown in Fig. 3. Fig. 4 shows the interior of the exhaust room with the sound level meter in a position to make measurements.

It is not always necessary to construct such a room. Often there is laboratory space already available which can be easily adapted to this use. Such a room can contain other laboratory equipment, if desired; the more equipment, the more diffuse and random the sound field will be.

With a room available, the next step is to select a standard noise source and get it calibrated at a reference laboratory. In this case the company selected one of its production units for this purpose. It was calibrated in the large reverberation room of the Riverbank Acoustical Laboratories of the Armour Research Foundation. A photograph taken during the test is shown in Fig. 5. The large vane, which rotates, and the cylindrical pillars serve to create a more random sound field. In the reference laboratories at Riverbank, as in several others, there are accurate sound measurement standards.

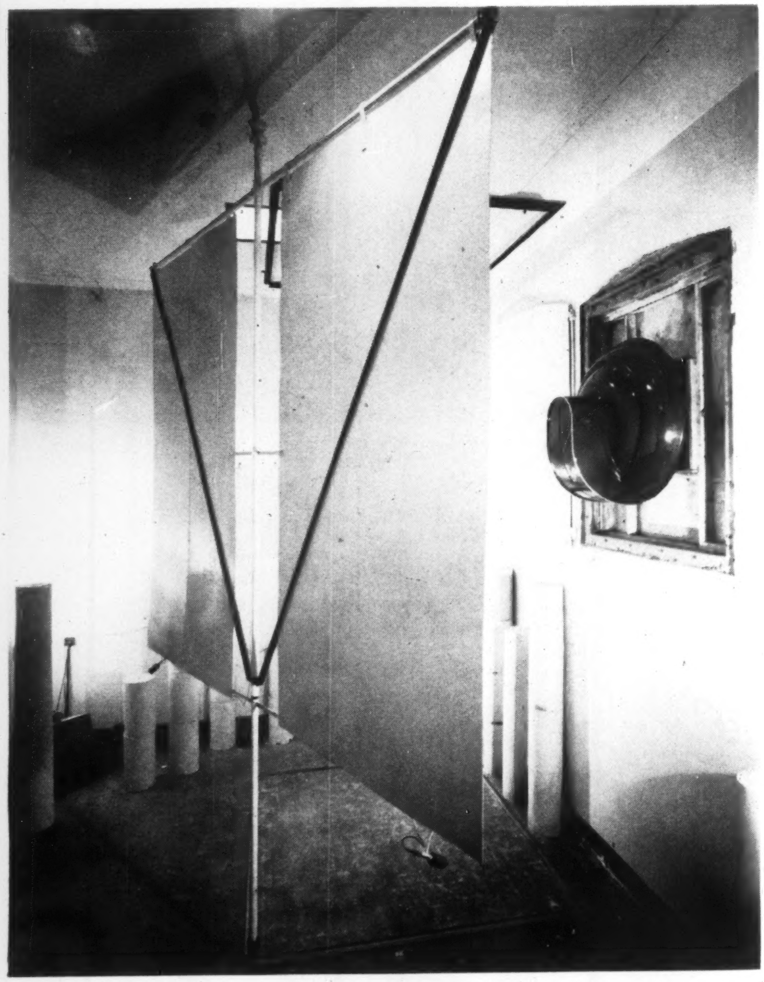
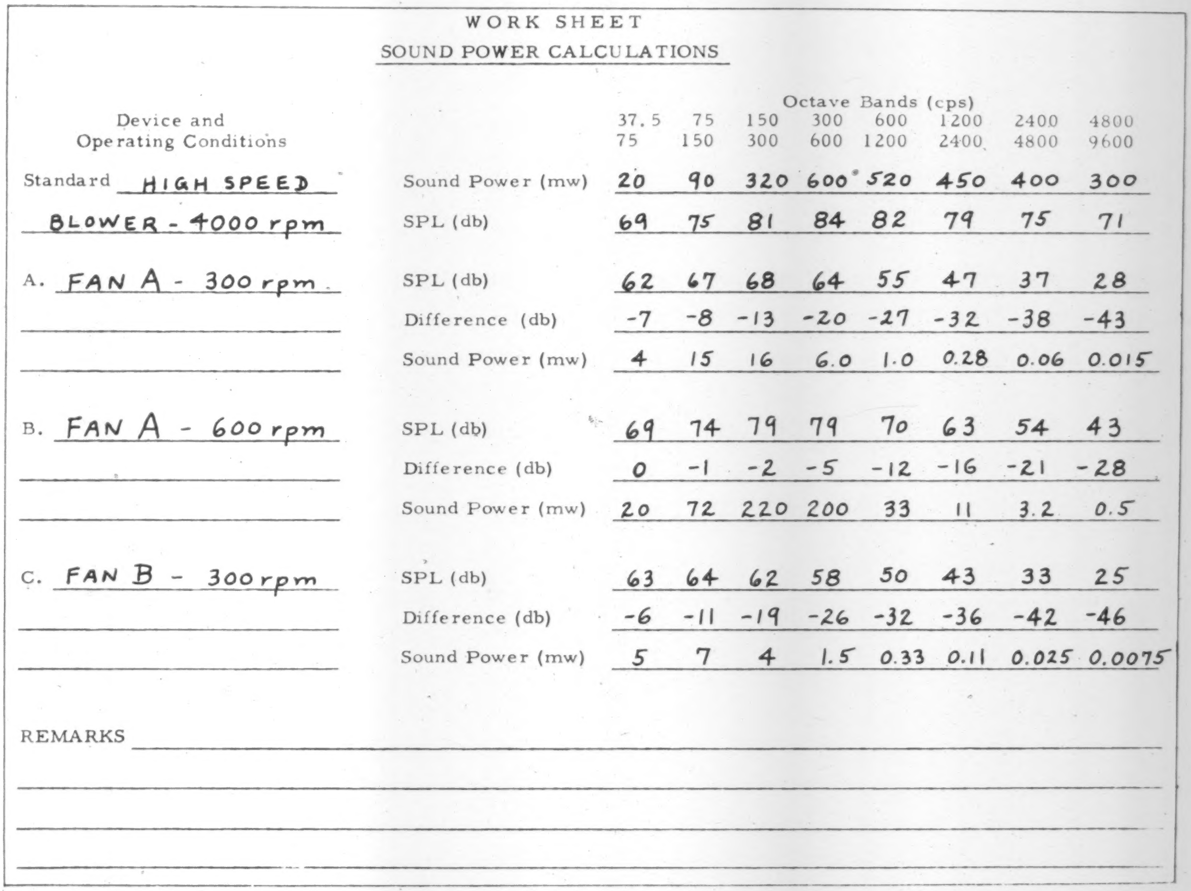


Fig. 5 — Centrifugal roof ventilator undergoing standard noise source calibration tests at Armour Research Foundation's Riverbank Laboratories

Many other types of standard noise sources have been developed. The most common are aerodynamic in nature, because such sources tend to have sound spectra free of harmonic resonances and pure tones. Some of these standard sources are not industrial products but have been devised to fit the needs of a particular industry. For instance, the compressed air tool industry is using an air jet opening into a small housing, a device without moving parts, which has a noise spectrum very close to that of compressed air tools. Such standard sources should have sound powers and spectra similar to the devices with which they are compared, and it is probable that many such standard noise sources will be available in the future.

An example of such sound measurements is given in a work sheet in Fig. 6. The standard is a small high



WORK SHEET

SOUND POWER CALCULATIONS

Device and Operating Conditions		Octave Bands (cps) 37.5 75	75 150	150 300	300 600	600 1200	1200 2400	2400 4800	4800 9600
Standard HIGH SPEED	Sound Power (mw)	20	90	320	600	520	450	400	300
BLOWER - 4000 rpm	SPL (db)	69	75	81	84	82	79	75	71
A. FAN A - 300 rpm	SPL (db)	62	67	68	64	55	47	37	28
	Difference (db)	-7	-8	-13	-20	-27	-32	-38	-43
	Sound Power (mw)	4	15	16	6.0	1.0	0.28	0.06	0.015
B. FAN A - 600 rpm	SPL (db)	69	74	79	79	70	63	54	43
	Difference (db)	0	-1	-2	-5	-12	-16	-21	-28
	Sound Power (mw)	20	72	220	200	33	11	3.2	0.5
C. FAN B - 300 rpm	SPL (db)	63	64	62	58	50	43	33	25
	Difference (db)	-6	-11	-19	-26	-32	-36	-42	-46
	Sound Power (mw)	5	7	4	1.5	0.33	0.11	0.025	0.0075

REMARKS

Fig. 6 — Sample work sheet showing sound power calculations for room fans

speed blower running at 4000 rpm. It has a power output in octave bands given by the first line. In the measurement room this amount of power results in a sound-pressure-level given by the second line.

On the rest of the work sheet are data for 2 ordinary room fans, one of them at 2 operating speeds. A calculation of the sound power requires finding the difference in sound-pressure-levels. The sound power is then calculated by the equation

$$P_1/P_2 = P_1^2/P_2^2 = \text{antilog}\ (SPL_1 - SPL_2)/10 \quad \ldots\ldots\ldots\ldots\ldots(8)$$

or graphically with a chart such as Fig. 1.

Conclusion

It can be seen that here are the elements of a noise measurement standard. The task now is to draw up a document embodying these concepts in a standard. It is possible to proceed with the knowledge that a good foundation is available. The problem will be in the details of construction.

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1. Evaluation of Four Methods for Determining Sound-Power Output of a Fan, by W. F. Kerka (ASHAE JOURNAL SECTION, *Heating, Piping & Air Conditioning*, April 1957, p. 139).

2. Sound Level Meters for Measurement of Noise and Other Sounds, Z24.3-1944. Specification for an Octave-Band Filter Set for the Analysis of Noise and Other Sounds, Z24.10-1953 (*American Standards Association*, New York, N. Y.).

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Don't forget the Pittsburgh Meeting

January 27-29, 1958

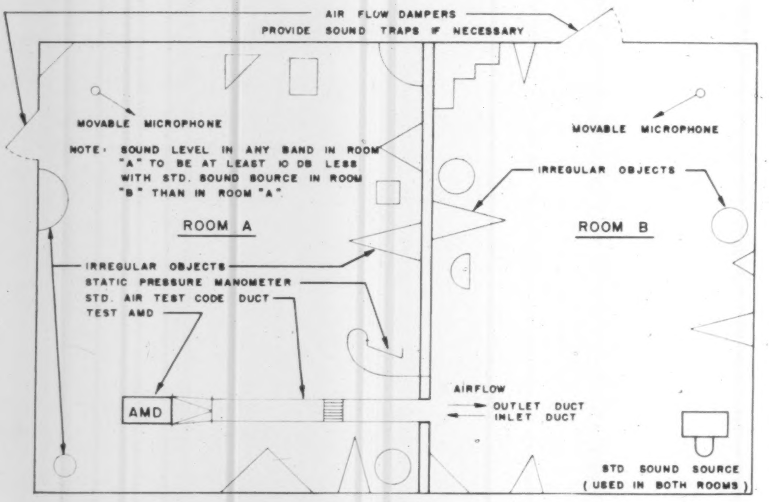
Application of Sound Standards to Equipment

By

R. E. Parker

The author is Vice President in charge of Research, Ilg Electric Ventilating Co., Chicago, Ill. The presentation was made at the Symposium on Sound and Vibration at the Semi-Annual Meeting of the AMERICAN SOCIETY OF HEATING AND AIR-CONDITIONING ENGINEERS, Murray Bay, Que., Canada, June 26, 1957.

IT WOULD not be overstating matters to say that the concept of sound power has lifted the field of noise control out of the *Dark Ages*. It is now universally accepted that sound rating of equipment in terms of a single sound level figure is of little value. The reasons for this are many, but the 2 most important ones are as follows.



Examples: Centrifugal fan, axial fan, power roof ventilator, central station cabinet type air-conditioning unit or evaporative cooler.

Fig. 1 — Sound test setup, air moving device (AMD) with duct

1. *Prediction of performance.* This is somewhat like measuring the temperature in a room heated by a unit heater and then saying that it would develop the same temperature in any room.
2. *Psychological aspects.* Because of the different sensitivities of the ear at different frequencies, subjective loudness does not correlate with single sound level figures on different types of sound sources.

It is mainly for these 2 reasons that present archaic sound test codes in the air moving and conditioning industry and many other industries must be rewritten. The *American Society of Refrigerating Engineers* has announced its intention to write a sound code based on the sound power concept in cooperation with ASHAE. The *American Standards Association* then plans to adopt a standard on sound testing based on the outcome of this work. The *Air Moving and Conditioning Association* has an engineering sub-committee on sound which intends to write a new sound code to replace the *NAFM* code[1]. The *American Institute of Electrical Engineers* is writing a sound code for electric motors.

The *NAFM* and *NEMA*[2] codes are now considered obsolete for the 2 reasons just mentioned. The *IUHA* sound code[3] is an improvement over previous types of codes, inasmuch as octave band analyses are specified and ratings are based on calculated subjective loudness.

It is visualized that a new sound test code for air moving devices, referred to as AMD's, can now be written around several basic setups based on the reverberant room method, as shown in Figs. 1 to 4. Note that a standard source is used, thus obviating the need for a knowledge of the acoustical room constant[4]. A free field test might also be specified for equipment of the type shown in Figs. 3 and 4 in order to obtain directivity factors (see Equation 4.) Space does not permit a more detailed outline of the possible specifications of the code.

The numerical values of the sound levels in rooms A and B are of no significance in themselves. The quantity calculated from these levels is the sound power of the source, which is a fundamental quantity used in the prediction scheme. For convenience in the calculations, it is felt that sound power should be stated in terms of decibels relative to 10^{-13} watts and called sound-power-level, or PWL.

For a single unit at a single operating condition, the PWL in octave bands could be stated directly. It would appear that the most practical method of cataloging ratings for a homologous series of AMD's would be somewhat as follows[5]. Most manufacturers now tabulate capacities in terms of so-called multi-rating tables in which each table refers to one size of unit. The only additional data required could be inserted in the catalog as follows:

---

[1] Exponent numerals refer to References.

1. At the top of each table, a simple formula relating cfm and rpm to the non-dimensional *rating point* could be given. This is expressed as the ratio of cfm to free air cfm for the same rpm.

2. A curve preceding the multi-rating tables showing specific sound-power-level (see Equation 1) *vs.* rating point for one or more of the following cases, whichever is applicable:
   - (*a*) Outlet of unit,
   - (*b*) Inlet of unit,
   - (*c*) Space around unit itself.

3. A conversion chart for specific sound-power-level, PWL_s, to overall PWL for any given cfm and SP. This would be based on the following equation[6]:

$$PWL_s = PWL - 10 \log_{10} (\text{cfm}) \times (TP)^2 \ldots\ldots\ldots\ldots\ldots (1)$$

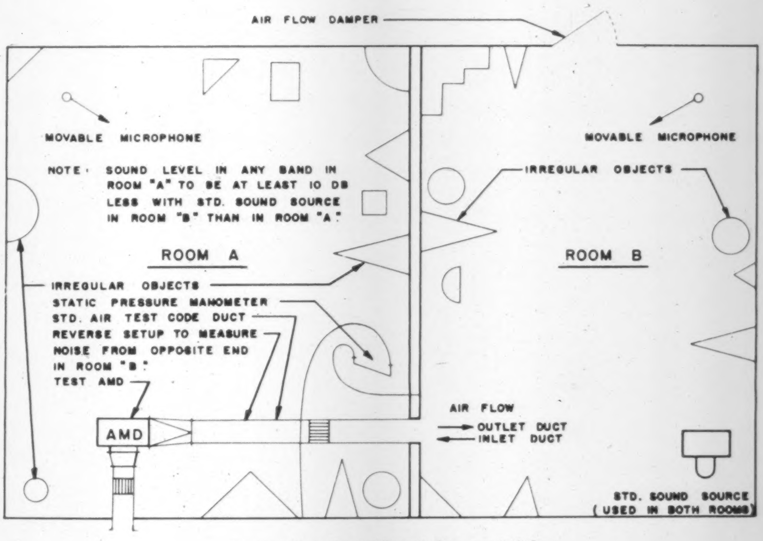
where

TP = AMD total pressure, inches water.

4. Typical frequency spectra by octave bands relative to PWL for different ranges of rpm for cases 2(*a*), (*b*), and (*c*).

5. Typical directionality curves for equipment of the type shown in Figs. 3 and 4.

It is unfortunate that there is not available a transducer to measure sound power directly in much the same way as a microphone measures sound pressure[7]. Thus, in order to obtain sound *power*, one must first measure sound *pressure* and calculate it by means of formulas which are different depending on the type of sound field. If the wrong assumption is made concerning the type of sound field, then the wrong formula will be used, and the calculated value of sound power will be incorrect. To make the situation even more complicated, there are 2 kinds of sound power of interest, namely *sound power density* and *sound power flux*, commonly called *sound power intensity*[8]. The former refers to the sum of the sound powers entering an element of volume regardless of direction, whereas the latter refers to the vector sum of the sound powers in a specified direction normal to an element of area.


AIR FLOW DAMPER
MOVABLE MICROPHONE
NOTE: SOUND LEVEL IN ANY BAND IN ROOM "A" TO BE AT LEAST 10 DB LESS WITH STD. SOUND SOURCE IN ROOM "B" THAN IN ROOM "A".
ROOM A
IRREGULAR OBJECTS
STATIC PRESSURE MANOMETER
STD. AIR TEST CODE DUCT
REVERSE SETUP TO MEASURE NOISE FROM OPPOSITE END IN ROOM "B".
TEST AMD
AMD
MOVABLE MICROPHONE
IRREGULAR OBJECTS
ROOM B
AIR FLOW
OUTLET DUCT
INLET DUCT
STD. SOUND SOURCE (USED IN BOTH ROOMS)

Examples: Centrifugal fan, axial fan.

Fig. 2 — Sound test setup, air moving device (AMD) with outlet and inlet ducts

It will be noted that an in-duct test method is not recommended. Research to date[9,10] would seem to indicate that it is impractical.

It is particularly difficult to measure the sound power traveling down a duct, as it cannot be assumed that free-field conditions exist. If such were the case, the sound power intensity would be given by

$$PWL = SPL + 10 \log A - 0.5 \ldots (2)$$

where

SPL = sound level re 0.0002 dynes/cm.^{2}

A = area of duct, square feet.

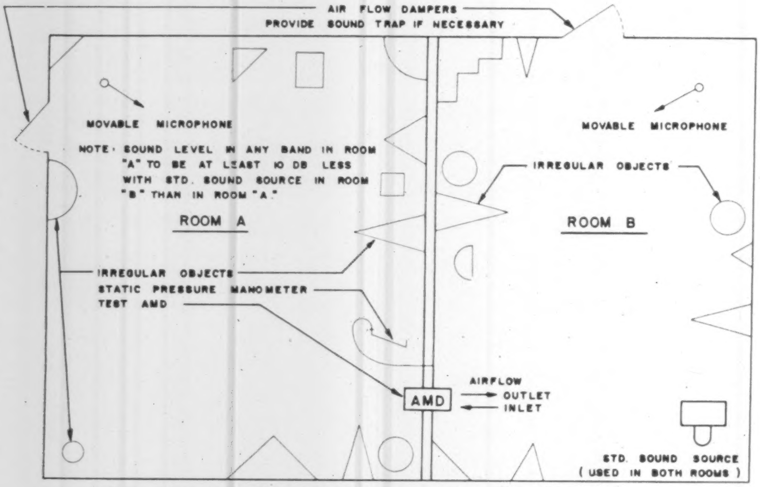
at normal atmospheric conditions (see Equation 3). This simple relationship does not exactly hold for the following reasons.

1. At high frequencies, the sound field within the duct is reverberant, and Equation 2 does not apply.
2. Transverse or longitudinal standing waves are obtained at frequencies for which one-half wavelength is equal to the duct transverse dimension and the duct length, respectively, and at multiples of these frequencies.
3. At low frequencies, the change in acoustic impedance at the open end of the duct causes a certain fraction of the sound wave, and the intensity associated with it, to be reflected, while the entire remainder is radiated. It should be stressed that no power is dissipated at the duct opening. The presence of the reflected wave means that the use of Equation 2 would be incorrect. An anechoic termination may be added to the duct to reduce these effects, but they may not be completely eliminated.

In order to illustrate the latter point, refer to Fig. 5. If there is absolutely no dissipation, as in case 1, a state of equilibrium is attained in which the amount of power radiated out of the duct is equal to that produced by the source in the duct. The sound power *intensity* is the same in the duct as it is beyond the duct ends, while the sound power *density* within the duct is much higher than under free-field conditions. Incidentally, an AMD may be considered a very high impedence sound source, that is, its output is not affected by reflected sound.

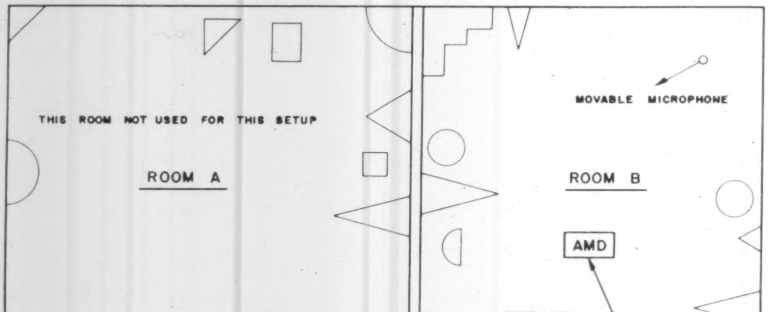
If there is dissipation within the duct, as in case 2, the amount of sound power radiated out of the end of the duct will be less than with no dissipation, case 1. The sound power *density* within the duct will also be reduced compared to case 1, but still will be greater than if free-field conditions existed. In this example, the dissipation is obtained mainly through the AMD itself, inasmuch as unlined duct has practically no attenuation.

If one duct end is made non-reflective, as in case 4, then sound power tends to take the path of least resistance and drains away from the reflective path to increase the amount radiated down the non-reflective path. This is seen by comparing the values at plane 2 for cases 2 and 4. The end reflection correction, B, is then exactly the same as the PWL deficiency at plane 4.


AIR FLOW DAMPERS
PROVIDE SOUND TRAP IF NECESSARY
MOVABLE MICROPHONE
NOTE: SOUND LEVEL IN ANY BAND IN ROOM "A" TO BE AT LEAST 10 DB LESS WITH STD. SOUND SOURCE IN ROOM "B" THAN IN ROOM "A."
ROOM A
IRREGULAR OBJECTS
STATIC PRESSURE MANOMETER
TEST AMD
AMD
AIRFLOW
OUTLET
INLET
MOVABLE MICROPHONE
IRREGULAR OBJECTS
ROOM B
STD. SOUND SOURCE (USED IN BOTH ROOMS)

Examples: Centrifugal fan, axial or propeller fan, power roof ventilator, cabinet-type air conditioner, unit ventilator.

Fig. 3 — Sound test setup, air moving device (AMD) without duct


THIS ROOM NOT USED FOR THIS SETUP
ROOM A
MOVABLE MICROPHONE
ROOM B
AMD
TEST AMD
ALTERNATE LOCATION FOR TEST AMD
IRREGULAR OBJECTS
STD. SOUND SOURCE

Examples: Unit heater, air circulator.

Fig. 4 — Sound test setup, unitary air moving device (AMD)

Case 2 corresponds most closely to the setups of Figs. 1 and 2 at low frequencies. It is seen that the sound power in room B is somewhat less than the true sound power of the AMD due to the end reflection correction. This correction for the lower octave bands for various sizes of ducts is shown in Fig. 6. This is a theoretically derived quantity[11], which is included in another form in THE GUIDE 1957*. Note that the term *end reflection loss* is not used because there is no dissipation at the duct end and sound power intensity remains the same outside the duct as it is inside. For this reason, it is felt that a better term would be *end reflection correction.*

Prediction Scheme

Chapter 10 of THE GUIDE* was completely rewritten for the 1957 edition. A prediction scheme is very specifically spelled out involving an analysis of the 3 major elements of the system, namely

1. source.
2. path.
3. receiver.

This is an engineering method to determine before installation whether a device will be suitable acoustically or whether attenuation must be added to the path. This is based on the following fundamental equation[12]:

$$\text{PWL} = \text{SPL} - 10 \log_{10} [(Q/4\pi r^2) + (4/R)] - 0.5 + 10 \log_{10} (30/B) \sqrt{K/293} \quad \ldots\ldots (3)$$

Q = directivity factor.
r = distance from source, feet.
R = room constant, square feet.
B = barometric pressure, inches Hg.
K = air temperature, Kelvin degrees.

The symbols PWL and SPL were previously defined. For normal atmospheric conditions, the last term is omitted.

This equation has several special cases of interest, including the following.

1. Free-field or anechoic room:

$$\text{PWL} = \text{SPL} + 20 \log r + 10.5 - 10 \log Q \quad \ldots\ldots\ldots\ldots (4)$$

$R = \infty$ in Equation 3

2. Diffuse field in reverberant room:

$$\text{PWL} = \text{SPL} + 10 \log R - 6.5 \quad \ldots (5)$$

$r = \infty$ in Equation 3

Note that if 2 sources are used, R can be eliminated, and

$$\text{PWL}_1 - \text{PWL}_2 = \text{SPL}_1 - \text{SPL}_2 \quad \ldots (6)$$

---

*HEATING VENTILATING AIR CONDITIONING GUIDE 1957 (published by the AMERICAN SOCIETY OF HEATING AND AIR-CONDITIONING ENGINEERS, New York, N. Y.).

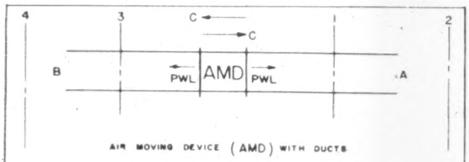
3. Free-field in duct:

$$\text{PWL} = \text{SPL} + 10 \log A - 0.5 \quad \ldots\ldots (2)$$

$A = 4\pi r^2$ in Equation 3.
$Q = 1.$
$R = \infty.$

For a branch duct of area A_b which is one of the branches of total area A_t coming from a trunk, then

$$\text{PWL}_b - \text{PWL}_t = 10 \log A_b/A_t \quad \ldots (7)$$



AIR MOVING DEVICE (AMD) WITH DUCTS

CASE	END REFLECTION CORRECTION, DB A	END REFLECTION CORRECTION, DB B	DISSIPATION DB C	DIFFERENCE FROM TRUE PWL, DB END A 1	END A 2	END B 3	END B 4
1	16	16	0	+19.0	0	+19.0	0
2	16	16	2	+7.1	-11.9	+7.1	-11.9
3	16	16	4	+5.1	-13.9	+5.1	-13.9
4	0	16	2	+2.1	+2.1	+3.0	-16.0
5	3	16	2	+4.4	-.6	+4.6	-14.3

NOTE 1 VALUES FOR PLANES 1 AND 3 REFER TO SOUND POWER DENSITY RELATIVE TO FREE FIELD CONDITIONS, AND NOT SOUND POWER INTENSITY

2 FOR SAKE OF SIMPLICITY, REFLECTION AT THE CONNECTIONS OF THE AMD TO THE DUCTS IS ASSUMED ZERO

3 FOR SAKE OF SIMPLICITY, THE AMD IS ASSUMED TO RADIATE EQUAL POWER INTO BOTH DUCTS.

4 PWL IS SOUND POWER IN DB RE 10^{-13} WATTS.

5 SMALL END CORRECTION, CASES 4 AND 5, OBTAINED WITH LARGE AREA RATIO, NON DISSIPATIVE HORN

Fig. 5 — Sound power relationships, ducted air moving device

One element of the prediction scheme for which little data are available is diffuser noise. Depending on the air velocities through them, they may attenuate the system noise or increase it due to aerodynamic noise generation. Manufacturers of these devices have expressed great interest in developing a sound code. The Guide shows some data for the aerodynamic noise of plain perforated grilles and vane deflection grilles on the basis of the average PWL in the octave bands most important to speech communication, namely 600 to 4800 cps. No data are given for draftless aspirating-type air diffusers.

The first and foremost consideration in the prediction scheme is the satisfaction of the receiver. The design goal or criterion in the occupied space must be chosen with utmost care. This element of the prediction scheme has received much attention and there have been some notable changes in published data in this regard. For example, the calculation of subjective loudness has changed from the equivalent tone method[13] to the Stevens method[14]. A chart for the calculation of loudness in units of sones is shown in Fig. 7. A com-

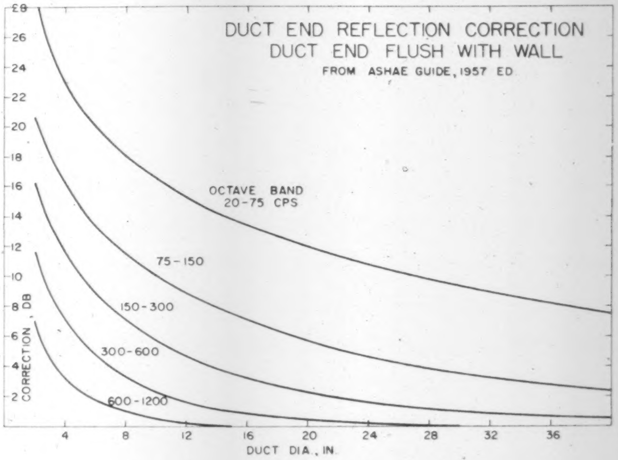


Fig. 6 — Duct end reflection correction duct end flush with wall

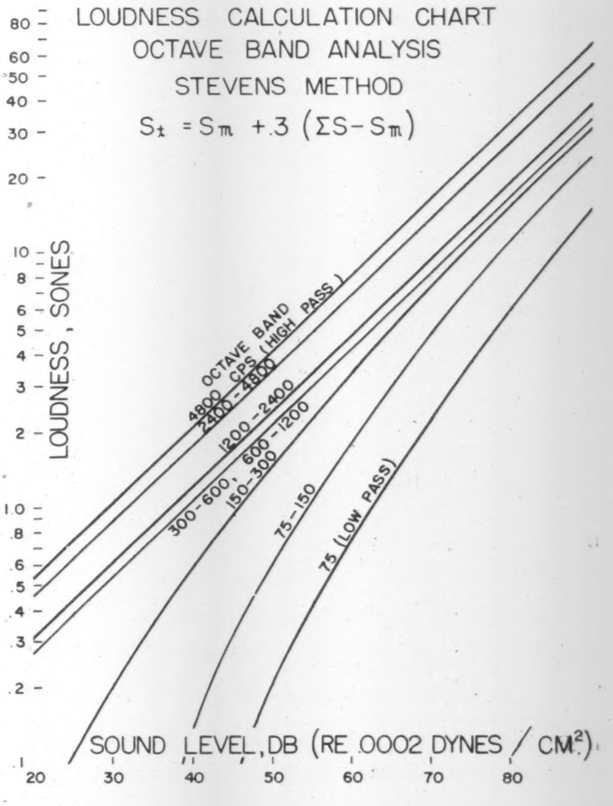


Fig. 7 — Loudness calculation chart

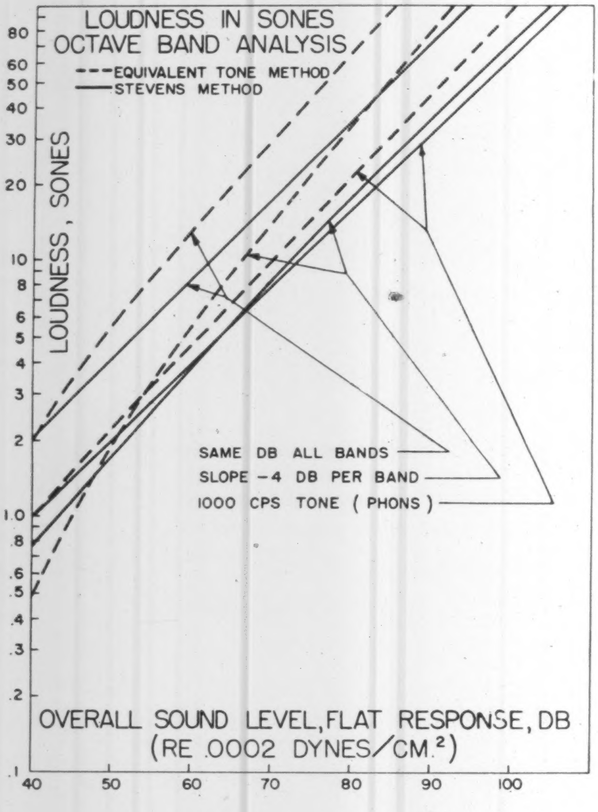


Fig. 8 — Loudness in sones, octave band analysis

parison of results by the methods is given by Figs. 8 and 9. These comparisons are on the basis of 2 different types of sounds which, when analyzed by octave bands, show, (1) the same SPL in all bands, and (2) a drop of 4 db in SPL in each successively higher octave band. The reason for using such sounds is that, roughly speaking, AMD noise generally falls between these extremes. It is interesting to note that loudness may be expected to double for a 10 db increase in sound level.

The use of suitable criteria is a subject by itself. There are 2 ways to look at criteria. The first involves the judgment of existing conditions in an occupied space. The use of *A scale* SPL readings has been suggested[15]. The use of a loudness level of 62 db or a loudness of 4.5 sones by the Stevens method has been suggested[16] as a marginally acceptable background noise in occupied spaces. Difficulty of speech communication at various values of the *speech interference level,* or average of the SPL's in the octave bands between 600 and 4800 cps, has been reported[17].

The second way to look at criteria involves the establishment of a suitable design goal for an occupied space for comparison with the results of the prediction scheme. For this it is necessary to specify the SPL in each octave band which will be acceptable in the occupied space. One obvious procedure is to measure the ambient sound level in octave bands and aim 5 db or so below this. However, in case these figures are not available or are unduly low, it is necessary to select a goal. Previous data on this subject[12,18] have been superseded by so-called NC and NCA curves[19], which are included in the latest edition of THE GUIDE. Suggestions for the particular curves which might be applicable to various types of environments are also included.

The procedure shown in THE GUIDE for attacking a noise control problem in a ventilating system is as follows. A similar prediction scheme has been applied by the Navy[20] with good results.

1. Find PWL of source by octave bands in the direction of interest. If manufacturer's ratings are not available, assume for AMD's that on an overall basis

$$\text{PWL} = 100 + 10 \log_{10} HP + 10 \log_{10} TP \quad \ldots\ldots\ldots (8)$$

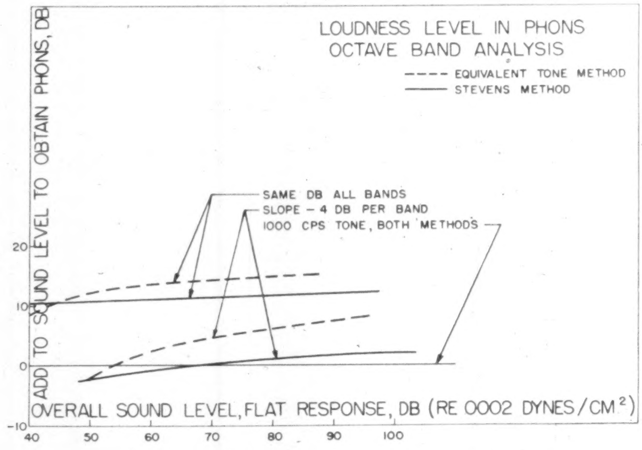


Fig. 9 — Loudness level in phons, octave band analysis

where

HP = rated hp of unit

Typical spectra of PWL by octave bands relative to overall PWL are shown in THE GUIDE for centrifugal fans and vane axial fans.

2. Determine the existing attenuation in the path by octave bands, for example,

natural duct losses, losses in bends, and reflection corrections at the outlet. Data on these items are shown in THE GUIDE.

3. Determine the net source PWL by octave bands at the outlet by subtracting 2 from 1.

4. Determine the diffuser PWL increase or attenuation, whichever the case may be by octave bands, either from ratings, actual measurements, or the data on grilles in THE GUIDE.

5. Add 3 and 4 to obtain the PWL at the diffuser by octave bands.

6. Determine the relative SPL for each octave band from the outlet to the specified listening location by using Equation 3. THE GUIDE gives this in graphical form, as well as data on the room constant *R*.

7. Determine the SPL in octave bands at the listening location by subtracting 6 from 5.

8. Subtract the design goal SPL values by octave bands obtained from the appropriate NC curve from 7 to determine the required amount of noise reduction in each band.

9. Choose an economical means of providing the required noise reduction. This may be obtained by adding an absorbing lining to the duct, plate or cell absorbers, a lined plenum, a lined square corner bend, a commercial package unit, and so on. Data on these by octave bands are included in THE GUIDE. Because noise may be induced by vibration, a consideration of the fan mounting may be necessary. Also, if the fan room is adjacent to a quiet space, the construction of the fan room walls to provide adequate noise reduction should require attention. Data on this were given in a recent article in *Noise Control* magazine[21]. It is usually good policy to provide slightly more acoustical treatment than necessary, thus obtaining a safety factor. A safety factor often used is 5 db greater noise reduction than would be indicated by the foregoing procedure.

It may be some time before the necessary source data and diffuser data become available, because codes must be written and tests made by equipment manufacturers. Even then there will be a tremendous educational job to be done before an engineer can obtain complete enough information to properly estimate the performance of equipment on specific proposed installations. The old question of *how many db's will it produce* will have to be accompanied by a lot of detailed information about the job, or otherwise the estimate will have to be given with the proper qualifications.

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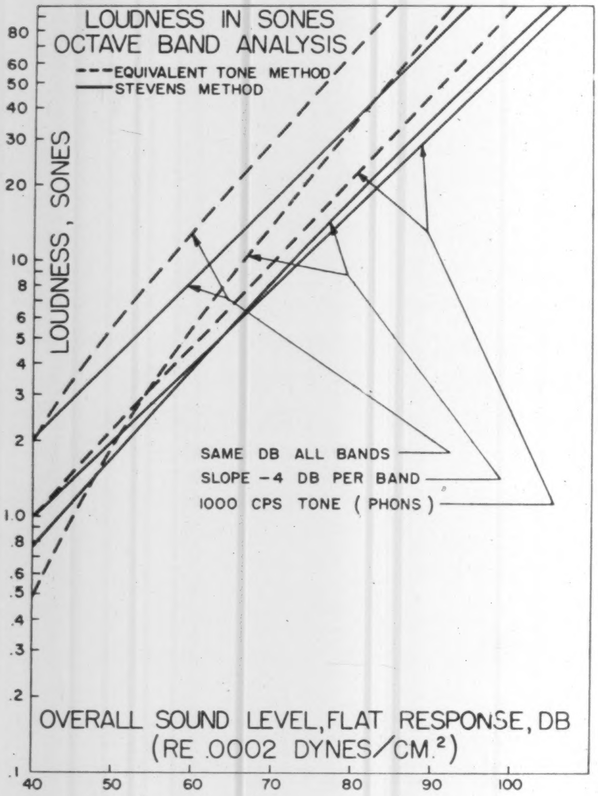

Fig. 8 — Loudness in sones, octave band analysis

parison of results by the methods is given by Figs. 8 and 9. These comparisons are on the basis of 2 different types of sounds which, when analyzed by octave bands, show, (1) the same SPL in all bands, and (2) a drop of 4 db in SPL in each successively higher octave band. The reason for using such sounds is that, roughly speaking, AMD noise generally falls between these extremes. It is interesting to note that loudness may be expected to double for a 10 db increase in sound level.

The use of suitable criteria is a subject by itself. There are 2 ways to look at criteria. The first involves the judgment of existing conditions in an occupied space. The use of *A scale* SPL readings has been suggested[15]. The use of a loudness level of 62 db or a loudness of 4.5 sones by the Stevens method has been suggested[16] as a marginally acceptable background noise in occupied spaces. Difficulty of speech communication at various values of the *speech interference level,* or average of the SPL's in the octave bands between 600 and 4800 cps, has been reported[17].

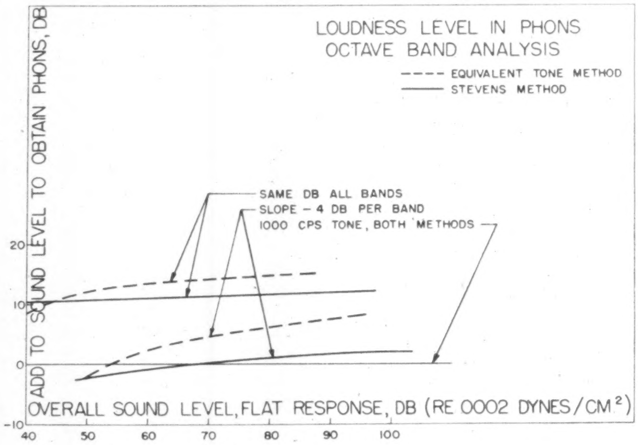

Fig. 9 — Loudness level in phons, octave band analysis

The second way to look at criteria involves the establishment of a suitable design goal for an occupied space for comparison with the results of the prediction scheme. For this it is necessary to specify the SPL in each octave band which will be acceptable in the occupied space. One obvious procedure is to measure the ambient sound level in octave bands and aim 5 db or so below this. However, in case these figures are not available or are unduly low, it is necessary to select a goal. Previous data on this subject[12,18] have been superseded by so-called NC and NCA curves[19], which are included in the latest edition of The Guide. Suggestions for the particular curves which might be applicable to various types of environments are also included.

The procedure shown in The Guide for attacking a noise control problem in a ventilating system is as follows. A similar prediction scheme has been applied by the Navy[20] with good results.

1. Find PWL of source by octave bands in the direction of interest. If manufacturer's ratings are not available, assume for AMD's that on an overall basis

$$PWL = 100 + 10 \log_{10} HP + 10 \log_{10} TP \quad \ldots\ldots\ldots (8)$$

where

HP = rated hp of unit

Typical spectra of PWL by octave bands relative to overall PWL are shown in The Guide for centrifugal fans and vane axial fans.

2. Determine the existing attenuation in the path by octave bands, for example,

natural duct losses, losses in bends, and reflection corrections at the outlet. Data on these items are shown in THE GUIDE.

3. Determine the net source PWL by octave bands at the outlet by subtracting 2 from 1.

4. Determine the diffuser PWL increase or attenuation, whichever the case may be by octave bands, either from ratings, actual measurements, or the data on grilles in THE GUIDE.

5. Add 3 and 4 to obtain the PWL at the diffuser by octave bands.

6. Determine the relative SPL for each octave band from the outlet to the specified listening location by using Equation 3. THE GUIDE gives this in graphical form, as well as data on the room constant *R*.

7. Determine the SPL in octave bands at the listening location by subtracting 6 from 5.

8. Subtract the design goal SPL values by octave bands obtained from the appropriate NC curve from 7 to determine the required amount of noise reduction in each band.

9. Choose an economical means of providing the required noise reduction. This may be obtained by adding an absorbing lining to the duct, plate or cell absorbers, a lined plenum, a lined square corner bend, a commercial package unit, and so on. Data on these by octave bands are included in THE GUIDE. Because noise may be induced by vibration, a consideration of the fan mounting may be necessary. Also, if the fan room is adjacent to a quiet space, the construction of the fan room walls to provide adequate noise reduction should require attention. Data on this were given in a recent article in *Noise Control* magazine[21]. It is usually good policy to provide slightly more acoustical treatment than necessary, thus obtaining a safety factor. A safety factor often used is 5 db greater noise reduction than would be indicated by the foregoing procedure.

It may be some time before the necessary source data and diffuser data become available, because codes must be written and tests made by equipment manufacturers. Even then there will be a tremendous educational job to be done before an engineer can obtain complete enough information to properly estimate the performance of equipment on specific proposed installations. The old question of *how many db's will it produce* will have to be accompanied by a lot of detailed information about the job, or otherwise the estimate will have to be given with the proper qualifications.

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Estimating Octave Band Levels of Noise Generated by Air-Conditioning Systems†

By

F. B. Holgate and Sidney Baken

Mr. Holgate is Head, Heating, Ventilating & Air-Conditioning Section, and Mr. Baken is Head, Noise Reduction Unit of the Heating, Ventilating & Air-Conditioning Section, Material Laboratory, New York Naval Shipyard, Brooklyn, N.Y. A presentation at the Symposium on Sound and Vibration at the Semi-Annual Meeting of the AMERICAN SOCIETY OF HEATING AND VENTILATING ENGINEERS, Murray Bay, Que., Canada, June 26, 1957.

AIR-CONDITIONING systems are a principal source of noise in many spaces aboard Naval vessels, and shipbuilders are now required to meet definite limits on machinery noise in compartments. In order to avoid alteration to a completed system it is important to know in advance of construction both the nature and extent of acoustical treatment likely to be necessary to ensure conformity with noise level requirements.

For this reason an urgent need developed for a simple method for estimating air-conditioning system noise which could be applied in a routine manner. Simplicity was essential because the designers who are responsible for meeting noise requirements generally do not have advanced knowledge in noise and acoustics.

To meet this need, the Bureau of Ships has forwarded to Navy shipbuilding activities and design agents the first draft of a method prepared by the Material Laboratory for their

Nomenclature

α_i = sound absorption coefficient of a surface.
a_i = sound absorption by an object, in sabins.
a_F = total sound absorption in a fan room, in sabins.
a_R = total sound absorption in a compartment, in sabins.
c = velocity of sound in air, feet per second.
HP = rated power of a fan motor, in horsepower.
N = a number equal to a difference in decibels.
P_R = root mean square sound pressure in the reverberant field in a compartment, in dynes per square centimeter.
P_T = root mean square sound pressure at ventilation terminals, in dynes per square centimeters.
P = nominal rated pressure developed by a fan, in inches of water.
ρ = air density, pounds per cubic foot.
S_D = cross-sectional area of a duct at the start of a system, in square feet.
S_i = area of a sound absorbing surface, in square feet.
S_F = average cross sectional area of the fan intake and fan discharge, in square feet.
S_P = surface area of a partition between a fan room and contiguous compartment, in square feet.
S_T = total terminal area, in square inches.
SIL = speech interference level, which is the arithmetic average of the levels in the four octave bands from 300 cps to 4800 cps.
SPL_D = overall sound-pressure-level at the area, S_D, in decibels relative to 0.0002 dynes per sq cm.
SPL_F = overall sound-pressure-level at the area, S_F, in decibels relative to 0.0002 dynes per sq cm.
SPL_P = overall sound-pressure-level on the fan room side of a partition between a fan room and a contiguous space, in decibels relative to 0.0002 dynes per sq cm.
SPL_R = overall sound-pressure-level in the reverberant field in a compartment, in decibels relative to 0.0002 dynes per sq cm.
SPL_T = overall sound-pressure-level at ventilation terminals, in decibels relative to 0.0002 dynes per sq cm.
TL = Transmission loss of a partition, in decibels.

Table 1—Sound-pressure-levels in octave bands relative to overall sound-pressure-levels developed by Navy standard fans, in decibels[a]

Octave Band Limits, cps	Relative Level, Decibels Navy St'd. Vaneaxial	 Navy St'd Centrifugal
37.5-75	− 9	− 2
75-150	− 7.5	− 7
150-300	− 7	−12
300-600	− 7	−17
600-1200	− 7.5	−22
1200-2400	− 9	−27
2400-4800	−13	−32
4800-9600	−17	−37

[a] Overall sound-pressure-level ($SPL_F = 100 + 10 \log (HP/S_F) + 10 \log P$.

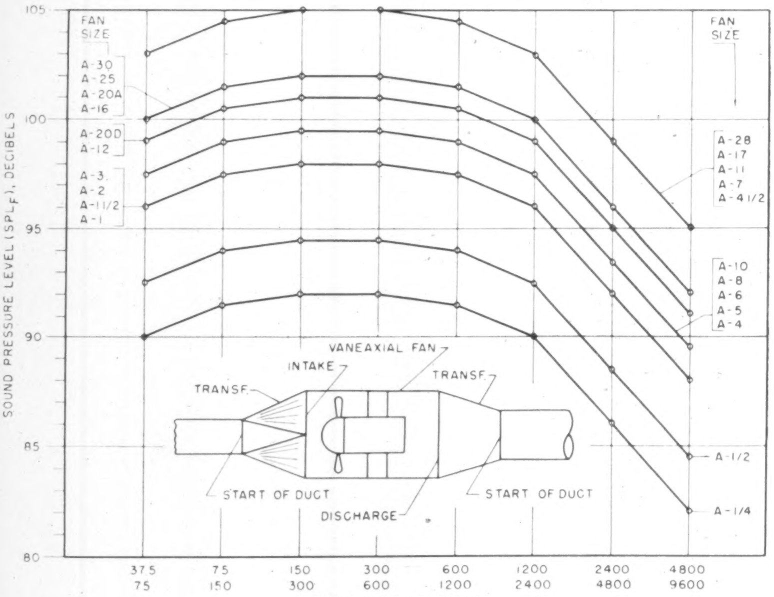

Fig. 1 — Sound-pressure-levels at intake and discharge of Navy standard vaneaxial fans

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†The opinions or assertions contained in this paper are the private ones of the authors and are not to be construed as official or reflecting the views of the Navy Department or the Naval Service at large.

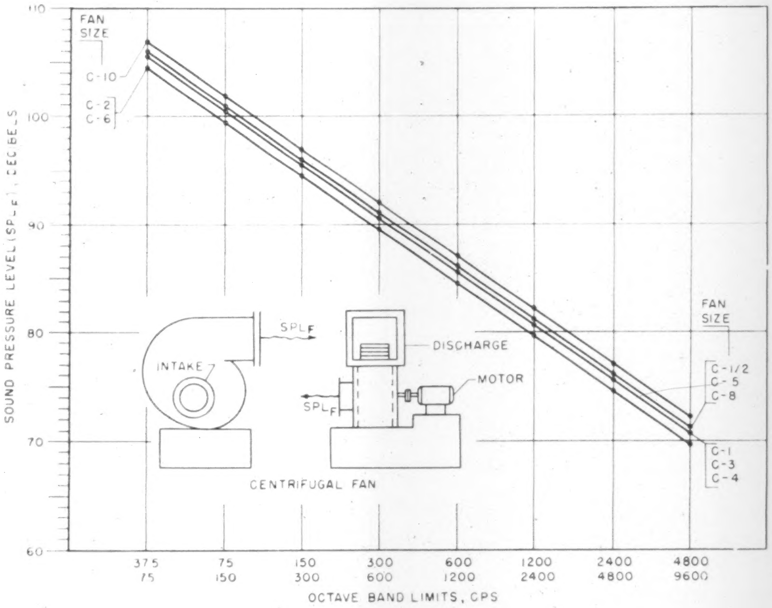

Fig. 2 — Sound-pressure-levels at intake and discharge of Navy standard centrifugal fans

use and guidance. Excepting for some changes in the details, this paper describes that method.

The scope of this paper is limited to consideration of the noise sources which are most frequently encountered in compartments aboard Naval vessels. These include noise which originates at a Navy standard vane-axial or centrifugal fan and emanates from terminals or is transmitted through a bulkhead partition between a fan room and a contiguous space.

In the future, methods will be developed for estimating levels of noise:

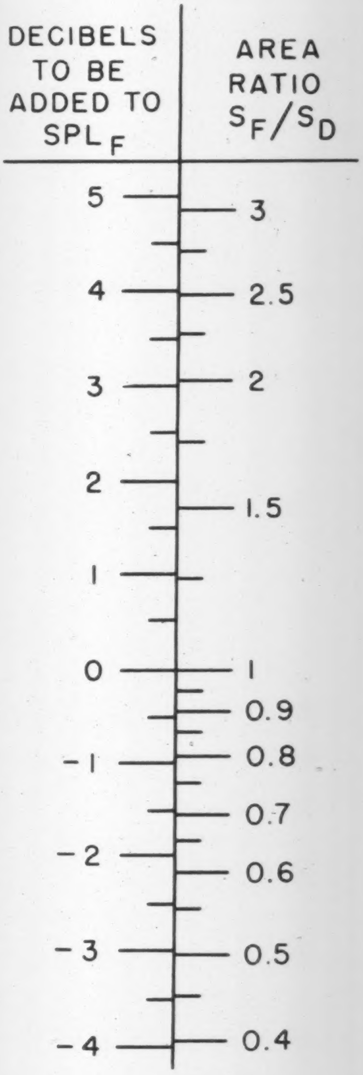

Fig. 3 — Scale for relating sound-pressure-level at a fan intake or discharge to sound-pressure-level at the start of the duct

1. Transmitted through duct walls.

2. Transmitted through recirculation openings in plenums located within inhabited spaces.

3. Generated when unit coolers and unit heaters are in operation.

Table 2—Estimated attenuation by duct system components, in decibels

NAVY ST'D VANED ELBOWS	NO OF ELBOWS PER SYSTEM	OCTAVE BAND LIMITS, CPS								OCTAVE BAND LIMITS, CPS							
		37.5 75	75 150	150 300	300 600	600 1200	1200 2400	2400 4800	4800 9600	37.5 75	75 150	150 300	300 600	600 1200	1200 2400	2400 4800	4800 9600
90°	1	1.5	1.5	4	7	9	8.5	8	7	1.5	1.5	5.5	10.5	15	15	15	12.5
	2	1	1	3	4.5	6	5.5	5	4.5	1.5	1.5	3.5	7	8	8	8	7.5
	3	1	1	2.5	3.5	4.5	4	4	3.5	1.5	1.5	2.5	5	5.5	5.5	5.5	5
	4	1	1	2	3	3.5	3	3	3	1.5	1.5	2	3.5	4.5	4.5	4.5	4
	5 OR MORE	1	1	1.5	2.5	3	2.5	2.5	2.5	1.5	1.5	2	3	3.5	3.5	3.5	3.5
60°	1	1	1	2	4	6	7	7	7	1	1	4	6	8	10	10	8
	2	1	1	1.5	2.5	3.5	4	4	4	1	1	2.5	3.5	5	7	7	5.5
	3	1	1	1.5	2	3	3	3	3	1	1	2	3	3.5	5	5	4
	4 OR MORE	1	1	1.5	1.5	2.5	2.5	2.5	2.5	1	1	1.5	2.5	3	4	4	3
45°	1	0.5	1	1.5	2	4	5	6	6	0.5	1	2	4	6	8	8	6
	2	0.5	1	1	1.5	3	3	3.5	3.5	0.5	1	1.5	2.5	3.5	4.5	4.5	3.5
	3 OR MORE	0.5	1	1	1	2	2	2.5	2.5	0.5	0.5	1.5	2	2.5	3.5	3.5	2.5
30°	1	0	0.5	1	1.5	2	2.5	3	3.5	0	0.5	1	2	4	5	7	7
	2 OR MORE	0	0.5	1	1	1	1.5	2	2	0	0.5	1	1.5	2	3	4	4
		UNLINED ELBOWS								SOUND ABSORBENT LINED ELBOWS							

COMPONENT	OCTAVE BAND LIMITS, CPS							
	37.5 75	75 150	150 300	300 600	600 1200	1200 2400	2400 4800	4800 9600
REFLECTION LOSS AT DUCT END OR TERMINAL	10	6.5	3.5	0	0	0	0	0
COOLING COIL AND AIR FILTER	0	0.5	1.5	3	4.5	5.5	7.5	8.5
HEATING COIL	0	0.5	1	1.5	2	2.5	3	3.5

UNLINED DUCT: ATTENUATION IS 0.10DB PER FT IN ALL OCTAVE BANDS

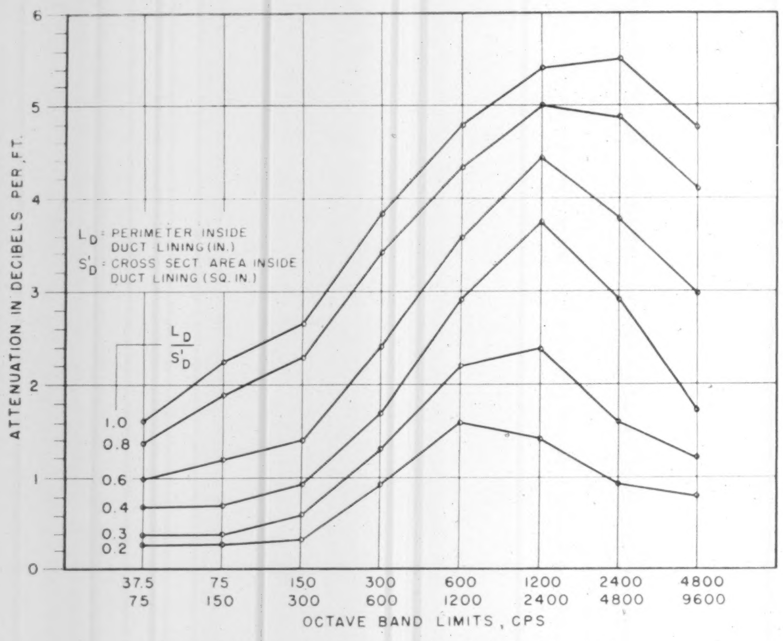

Fig. 4 — Attenuation by ducts lined with 1 in. thick sound absorbing blanket used by the U.S. Navy

Causes of noise which are not dealt with in this estimating method, and which are controlled by other means, are: poor aerodynamic design of duct systems; excessive unbalance of fans; improper selection of a fan for a given system.

Background

More data than are presently available from the literature are required to develop satisfactory procedures for estimating noise. This obstacle was bypassed, by preparing estimates of the data for the temporary use of designers until factual data become available. The dangers of generalization from the limited experimental work done or oversimplification of aspects of the problem are acknowledged at the outset. On this basis, technical data were assembled in the form of graphs and tables in order to minimize the amount of numerical calculations.

The sound-pressure-levels, in octave bands, developed at the intake and discharge of Navy standard fans are shown on Fig. 1 and Fig. 2 and are based upon the following information reported by Clayton Allen[1]:

1. Overall sound-power-level (SPL) developed by fans.
2. The levels in 8 octave bands from 37.5 cps to 9600 cps relative to the overall level.
3. The expected spread of levels in any one octave band.

While it is useful to deal with sound-power-level in many instances, it was considered more convenient, in this case, for designers to deal solely with sound-pressure-level. Since these 2 levels may be related by the area through which the sound power is flowing, the basic equation presented by Allen was adapted as follows:

$$SPL_F = 100 + 10 \log (HP/S_F) + 10 \log P \;\ldots\ldots\ldots\ldots (1)$$

On the basis of an assumed distribution of octave band levels relative to the overall level, SPL_F, as shown in Table 1, curves on Fig. 1 and Fig. 2 were drawn. Such a distribution places Navy standard fans in the middle of the expected spread of levels reported by Allen. It is planned, however, to verify this assumption as a part of future work.

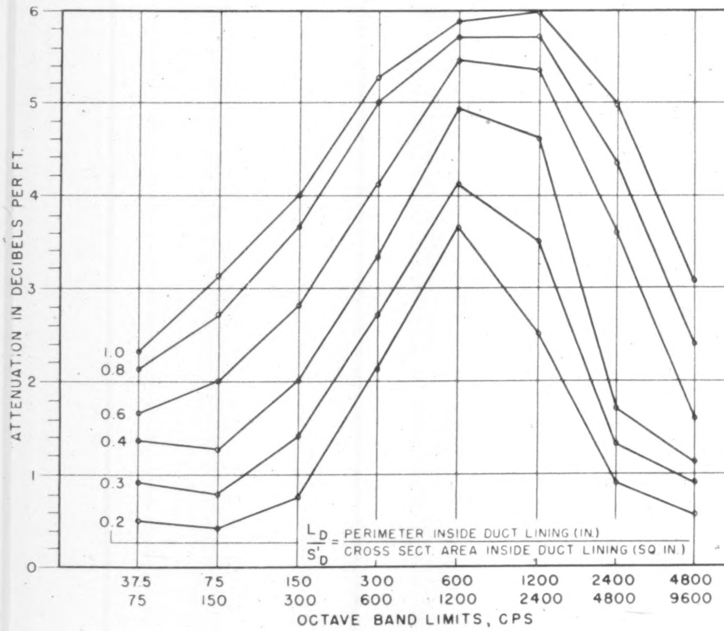

Fig. 5 — Attenuation by ducts lined with 2 in. thick sound absorbing blanket used by the U. S. Navy

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[1] Exponent numerals refer to References.

Other assumptions made in the preparation of Figs. 1 and 2 are:

1. Sound power developed by the fan is invariant with respect to the configuration of ducts which may be attached to the fan intake or discharge, and that this power radiates in equal amounts through both the intake and discharge.
2. Air pressures developed by fans are either 2, 2.5, 3 or 6 in. of water as determined by standard performance curves.

Navy standard fans are often connected to duct systems through transformations. The cross-sectional area at the start of the duct system after the transformation may differ substantially from that at the intake or discharge. On the basis of constant sound power, sound-pressure-levels at the 2 locations will differ by a number of decibels equal to 10 times the log of the area ratio. Fig. 3 is used for making such calculations since it is the sound-pressure-level at the start of the duct which is of greatest interest to the designer.

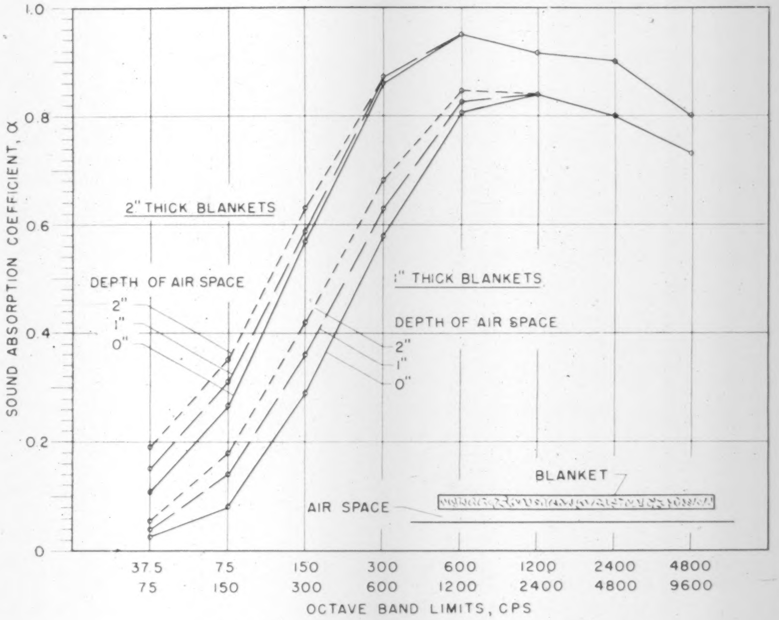


Fig. 7 — Estimated sound absorption coefficients of 1 in. thick and 2 in. thick sound absorbing blankets used by U.S. Navy

Estimates of attenuation by duct system components are shown on Fig. 4, Fig. 5 and Table 2. These are based upon limited measurements of attenuation without airflow which were made at the Material Laboratory. For this purpose, octave bands of noise obtained by filtering *white noise* and a loudspeaker source were used.

In the absence of definite information regarding noise generation characteristics of Navy standard elbows and other components, or noise generated by airflow across perforated metal facings installed over sound absorbent duct linings, it was assumed that:

1. The attenuation per elbow decreases as the number of elbows increases.
2. A maximum attenuation of 25 db in any one octave band is provided by duct linings regardless of length.

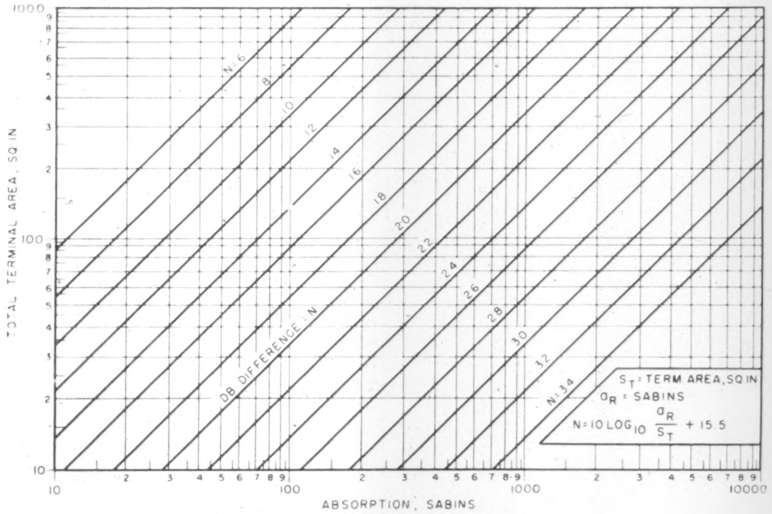


Fig. 6 — Difference between sound-pressure-levels at ventilation terminals and work positions in a space

In shipboard ventilation systems, air velocities in ducts may range up to 3500 fpm. Regeneration of noise, depending upon air velocity as well as the characteristics of Navy standard components, places a practical limit on the attenuation which can be achieved. Restrictions were placed upon the attenuation by elbows and duct linings because they provide the greatest attenuations of all the different components.

Devices other than those shown on Figs. 4 and 5 or listed in Table 2 may be used for the express purpose of providing attenuation. While performance data are not included here, consideration is sometimes given to acoustical filters which must be custom designed, or commercial prefabricated sound absorbers which offer high attenuations in a short

Table 3—Absorption coefficients of materials, a_i, and absorption of objects in sabins

			OCTAVE BAND LIMITS, CPS							
			37.5 75	75 150	150 300	300 600	600 1200	1200 2400	2400 4800	4800 9600
MATERIALS		THERMAL LAGGING	0.05	0.10	0.15	0.20	0.20	0.25	0.25	0.20
		CARPET	0.04	0.08	0.10	0.15	0.20	0.25	0.20	0.15
		WOOD SURFACES	0.10	0.10	0.10	0.10	0.10	0.10	0.10	0.10
		RUBBER FLOOR MAT	0.02	0.03	0.04	0.06	0.10	0.08	0.06	0.06
		BARE STEEL PLATE	0.01	0.02	0.03	0.03	0.03	0.02	0.02	0.02
OBJECTS	NAVY MATTRESS	HORIZONTAL (BERTHING) POSITION	6	8	11	19	21	20	20	21
		VERTICAL (STOWED) POSITION	12	13	14	17	17	16	16	17
		HUMAN	1	2	3.5	4	4.5	4.5	4.5	4.5

length of duct. In either case, their use in lieu of standard lined duct construction must be justified in terms of cost or space required.

A chart, shown in Fig. 6, was prepared for calculation of the difference of sound-pressure-levels at ventilation terminals and at work positions in compartments, assumed to be 5 ft from the terminals. This chart is based upon the assumption that plane waves exist in the ducts and that work positions lie in the reverberant field where sound-pressure-level is constant. When equilibrium obtains after an air-conditioning system is put into operation, the sound power propagated through the terminals equals that absorbed within the compartment.

Stated mathematically:

$$P_T^2S_T/\rho c(144) = P_R^2a_R/4\rho c \quad ....(2)$$

By introducing the decibel notation, Equation 2 may be put into the following form:

$$N = SPL_T - SPL_R = 10 \log (a_R/S_T) + 15.5 \quad ....(3)$$

Equation 3 is written in terms of overall sound-pressure-levels but it is equally valid for computing differences in octave band levels. This requires only that on Fig. 6, the designer use the value of a_R which applies to a particular octave band.

A necessary condition for Equation 3 to be valid is that sound-pressure-level be the same at all terminals. This condition, established by the procedures which are used, permits the designer to deal directly with total terminal area. The design of the terminals, expected number and probable locations within a compartment are such that collectively they may be assumed to be non-directional in regard to propagation of sound. The terminals in question are Navy standard equipment, such as diffusing terminals or so-called Type E and Type J terminals whose areas at the mouth are specified on standard plans.

Shipboard compartments usually have large exposed surfaces of steel and are moderately reverberant so that the assumption that work positions lie in the reverberant field is usually a good one. It may not hold, however, for compartments which are very small, or of unusual shape, or which contain equipment large

Table 4—Transmission loss through 1/16 in. steel partitions, in decibels

Octave band limits, cps	Trans. loss, decibels
37.5-75	13
75-150	17.5
150-300	21
300-600	25.5
600-1200	30.5
1200-2400	36.5
2400-4800	42.5
4800-9600	48.5

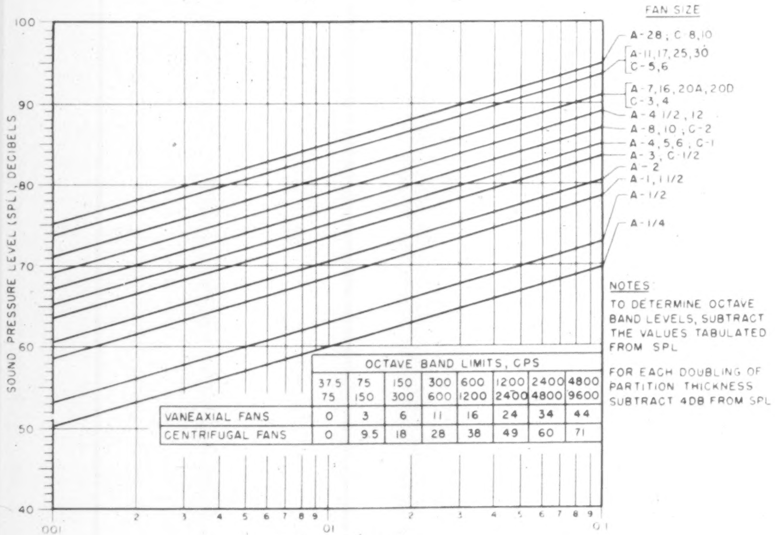
Source of data: Armour Research Foundation

Table 5—Permissible speech interference levels for shipboard compartments, in decibels

Noise Category	Vol. Cu Ft.	*SIL*
A[a]	500 to 1999	60
	2000 to 7999	55
	8000 and larger	50
E[b]	Any	72

[a] Compartments in which intelligible speech communication must be maintained. *Example:* Sonar room.

[b] High Noise level areas where intelligible speech communication is necessary. *Example:* Communication booth in main machinery room.



	OCTAVE BAND LIMITS, CPS							
	37.5 75	75 150	150 300	300 600	600 1200	1200 2400	2400 4800	4800 9600
VANEAXIAL FANS	0	3	6	11	16	24	34	44
CENTRIFUGAL FANS	0	9.5	18	28	38	49	60	71

NOTES:

TO DETERMINE OCTAVE BAND LEVELS, SUBTRACT THE VALUES TABULATED FROM SPL

FOR EACH DOUBLING OF PARTITION THICKNESS SUBTRACT 4DB FROM SPL

Fig. 8 — Transmission of noise through 1/16 in. thick steel partition

enough to serve as an acoustical barrier.

The designer is provided with the necessary data for computation of the total absorption according to the formula:

$$a_R = \Sigma\, \alpha_i S_i + \Sigma\, a_i \quad \ldots\ldots(4)$$

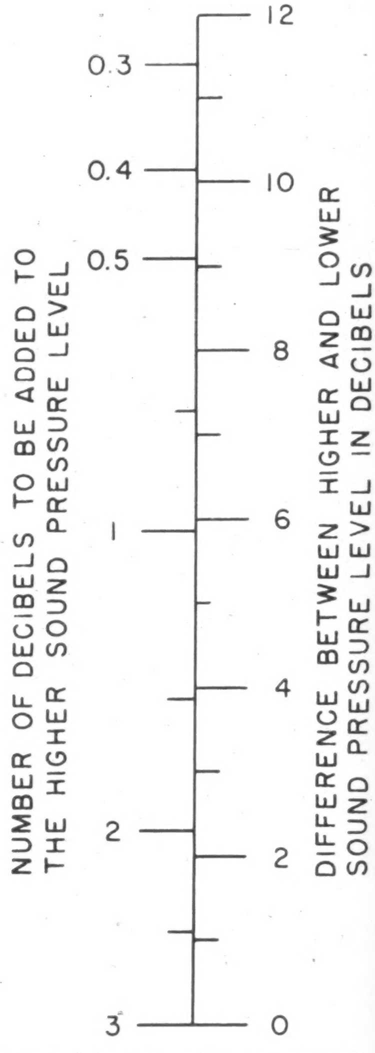


Fig. 9 — Scale for addition of 2 sound-pressure-levels

Absorption coefficients of 1-in. thick and 2-in. thick sound absorbing blankets which are used on surfaces of fan rooms or on the overhead of certain vital shipboard spaces are shown in Fig. 7 on an octave band basis. These are estimates made from reported results of tests conducted in reverberation chambers at specified frequencies. Table 3 shows the absorption provided by objects and the absorption coefficients of the more common surfaces which are encountered, also on an octave band basis. The absorption provided by air in compartments is assumed to be negligible.

The existence of problems involving transmission of noise generated by a fan through a partition has been indicated. With the aid of one chart, Fig. 8, the designer is able to compute octave band levels of noise in the compartment which adjoins a fan room. Fig. 8 is derived from the following formulas for over-all sound-pressure-level by taking into account the frequency dependence of transmission loss and total sound absorption.

Table 6—Permissible octave band levels for shipboard compartments, in decibels

NOISE CATEGORY	COMPARTMENT VOLUME, CU FT	OCTAVE BAND LIMITS, CPS							
		37.5 75	75 150	150 300	300 600	600 1200	1200 2400	2400 4800	4800 9600
B	500 TO 1999	86	82	78	74	70	66	62	58
	2000 TO 7999	82	78	74	70	66	62	58	54
	8000 AND LARGER	78	74	70	66	62	58	54	50
C	500 TO 1999	80	76	72	68	64	60	56	52
	2000 TO 7999	76	72	68	64	60	56	52	48
	8000 AND LARGER	72	68	64	60	56	52	48	44
D	ANY	115	110	105	100	95	90	85	85

CATEGORY B: COMPARTMENTS WHERE COMFORT OF PERSONNEL IS CONSIDERED TO BE AN IMPORTANT FACTOR. EXAMPLE CREW'S BERTHING

CATEGORY C: COMPARTMENTS IN WHICH ESPECIALLY QUIET CONDITIONS MUST BE MAINTAINED. EXAMPLE: FLIGHT CREW READY ROOM

CATEGORY D: COMPARTMENTS IN WHICH HIGH NOISE LEVEL IS EXPECTED AND DEAFNESS AVOIDANCE IS A GREATER CONSIDERATION THAN SPEECH INTELLIGIBILITY EXAMPLE MAIN MACHINERY ROOM

A general formula which relates overall sound-pressure-levels in the reverberant fields in a fan room and in a contiguous space is as follows:

$$SPL_R = SPL_F - TL + 10 \log (S_P/a_R) \quad \ldots\ldots\ldots\ldots\ldots(5)$$

where

$$SPL_F = 100 + 10 \log HP + 10 \log P + 10 \log (4/a_F) \quad \ldots\ldots(6)$$

Upon combination of Equation 5 and Equation 6, the following equation is obtained:

$$SPL_R = 106 + 10 \log (HP \times P) - TL + 10 \log (S_P/a_R a_F) \quad \ldots\ldots\ldots\ldots\ldots\ldots(7)$$

The level in a compartment in a particular octave band may be determined from Equation 7 if:

1. The particular value of transmission loss for that octave band, as in Table 4, is used for *TL*.
2. Values of a_R and a_F which correspond to the sound absorption in that octave band are used.
3. The relative difference between the overall sound-pressure-level and octave band level, as given by Table 1, are deducted from SPL_R.

The foregoing procedure was carried out in connection with each of the Navy standard fans for the 37.5-75 cps octave band. A 1/16 in. steel partition having a transmission loss of 13 db was assumed. Curves shown on Fig. 8 are the result of this set of operations. In effect then, Fig. 8 is direct reading for the 37.5 to 75 cps octave band once the designer evaluates $S_p/a_R a_F$ for the band. In regard to any other of the remaining bands, the designer determines a unique value of sound-pressure-level based upon the value of $S_p/a_R a_F$ for that band and simply deducts the appropriate number tabulated below the curves. The tabulation consists of numbers which are the combined differences in transmission loss and sound-pressure-levels developed by the fans, relative to those in the band from 37.5 to 75 cps.

Transmission loss data in Table 1 were provided by the *Armour Research Foundation*[2]. It is noted that levels in a compartment which adjoins a fan room are decreased by 1 db for each doubling of the thickness of the steel partition.

There are instances where a fan room houses more than one fan so that the designer is faced with the problem of finding the resultant sound-pressure-level in each octave band. This is done with the aid of Fig. 9. The designer takes each band in turn, starting with the 37.5 to 75 cps octave band, and computes the level created by each fan independently of other fans. Starting with the highest level, the resultant level is found by a process of successive summations. The summations are logarithmic and are carried out by using Fig. 9. Obviously, Fig. 9 can also be used for finding a resultant octave band level for noise which emanates from a terminal and noise which is transmitted through bulkheads.

Noise requirements for the various shipboard compartments are stated in the General Specifications for Ships of the U. S. Navy[3] and are based largely upon criteria for maximum allowable noise levels developed by Strasberg.[4] Noise requirements are shown on Tables 5 and 6. From these tables it is seen that the specified levels depend upon the noise category assigned to different spaces, as defined on the tables. In general, the specifications establish levels which will meet the needs of personnel in regard to deafness avoidance for long time exposure, and in regard to adequate speech intelligibility and comfort.

Steps in the Method

The following steps are taken by a designer when estimating octave band levels of noise emanating from terminals:

1. Allowable levels at work positions are selected from Table 5 or 6 depending upon noise category of the compartment and its volume. Noise categories of all shipboard compartments are listed in General Specifications. If an *SIL* is specified, it is necessary to assume a distribution of levels in the 4 octave bands which are averaged in computing the *SIL*. Reasonable levels relative to the *SIL*, which may be assumed for the 4 successive octave bands from 300 cps to 4800 cps are as follows:

Vaneaxial Fans: +6, 0, −2, −4;
Centrifugal Fans: +8, +3, −3, −8.

2. The designer determines, from general arrangement drawings available to him, if there are other machinery noise sources whose expected levels are of the same order as that created by the ventilation system. If so, 3 db are deducted from each of the octave band levels previously determined in preceding step 1. The allowances may be more refined if designers have specific information regarding the noise levels of other sources.

3. From preliminary drawings of the duct system the designer calaculates total terminal area making use of equipment handbooks. Total sound absorption in a compartment is computed on an octave band basis by means of Fig. 7 and Table 3. Using these data, and Fig. 6, the designer calculates the maximum allowable octave band levels at the ventilation terminals which will satisfy the requirements of the space.

4. Based upon fan size, sound-pressure-levels in octave bands at the intake and discharge of the fan are determined by means of Fig. 1 or Fig. 2. Octave band pressure levels at the start of the duct system after transformations attached to the fan are determined by means of Fig. 3.

5. The designer calculates the total attenuation along each path from the fan to a ventilation terminal using data in Table 2. From the foregoing, estimated octave band pressure levels at the ventilation terminals are computed. Duct lining is required if the estimated octave band pressure levels exceed those determined from step 3 preceding.

6. The required length of duct lining is determined from Fig. 4 or 5, assuming standard Navy construction will be used. When their use is justified, prefabricated commercial sound absorbers may be specified.

7. In practice, the designer starts with that branch containing the least number of elbows, particularly 90 deg elbows. If there is sufficient attenuation in this path the remaining paths need not be investigated.

As indicated in a previous paragraph the designer uses Fig. 8, and perhaps Fig. 9 to obtain estimates of noise transmitted through partitions. For purposes of noise reduction the preferred sequence of steps to be taken by a designer is as follows:

1. Specify sound absorbent lined ducts which are to be attached to the fan intake or discharge. Fans are often installed in fan rooms with no duct attached to one or the other end.

2. Increase the absorption in the fan room by the addition of sound absorbing materials.

If noise reduction beyond that provided by steps 1 and 2 is required, the problem is beyond the responsibility of the air-conditioning system designer. Other procedures for noise reduction remain, but they will not be discussed here.

Acknowledgment

The authors wish to acknowledge both the leadership and numerous constructive criticism offered since the inception of this work at the Material Laboratory by A. E. DeSomma of the Bureau of Ships, Code 431, and M. J. Berg, head, Mechanics Branch of the Material Laboratory. Acknowledgment is also made of the contributions of A. F. Phillips of the Bureau of Ships, Code 549, who did much of the work in developing a method for estimating overall levels of ventilation noise. That method is the predecessor of the one described in this paper. The authors also wish to express their thanks to colleagues at the Material Laboratory, L. B. Garner, P. Mantione and S. Solomon, for their assistance in various phases of this work and to Dr. R. W. Young, of U.S.N.E.L., for many helpful suggestions.

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Radiant Drafts from Cold Ceilings[†]

By Hans E. Ronge*, M.D., and Borje E. Lofstedt*, M.B., Uppsala, Sweden

SUMMARY — Contains a statement of methods of study and results of 20 tests made on 5 persons who, after spending from ½ to 1 hr beneath a warm ceiling, moved to beneath a cold ceiling in an experimental room and remained there until temperature measurements on various body surfaces indicated equilibrium with surroundings. Tests included condition of (1) upper body naked and subject at rest, (2) one layer clothes and subject at rest and (3) 2 to 3 layers of clothes on upper body and subject doing light work. Air temperature covered range from 60.8 to 68 F. Good correlation is shown between skin temperature equilibrium values and mean of air and ceiling temperature. A comfort chart based on the results is included. Experimental results were checked against measurements made in an underground factory room with cool ceiling.

THE LOSS of *dry* heat from the human body to the surrounding room is due to radiation and convection to surfaces or to air at lower temperatures than the body surfaces. It was not until the introduction of partitional calorimetry[1, 2] that it became possible to study the mutual significance of these 2 cooling processes. These investigations have since been widened considerably[3, 4, 5]. In Denmark, the problem has been dealt with by Pedersen[6, 7] and by Nielsen and Pedersen[8]. As variables such as velocity of air, temperature of skin and clothing surface, and the magnitude of the effective radiation or convection surface are included, the mutual relation between radiation and convection heat losses cannot be stated by a constant. For normal indoor conditions with the same air and radiation temperatures and the subject sitting or standing still and with an air velocity of 5-10 cm per sec it would seem that the convection losses preponderate to some extent over the radiation losses, partly due to the effective convection surface being larger than the effective radiating surface of the human body. Thus for standard conditions[1] with air velocity of 7.6 cm per sec the total radiation constant (with the effective body surface taken into account) is responsible for 48 percent of the total dry heat loss and the convection constant for 52 percent. Similar results, though with rather greater preponderance for the convection, were found by Nielsen and Pedersen[8]. These investigations apply to loss of heat from the *entire* human body.

A certain interest, not least from the practical point of view, lies also in investigations concerning convection and radiation losses from small, local surface areas of the human body. In the present investigation the effect of a cold ceiling on the temperature of the shoulders and neck and on the heat balance of the human body was studied. For certain premises with high rate of heat production, cooling by means of cold ceilings constitutes a suitable and practical method for carrying away surplus heat. It is then of practical interest to know the extent to which the cold ceiling can give rise to cold or draft sensations on the people on the premises and the extent to which this can be compensated by higher air temperatures. In this connection, there may be an influence from the circumstance that in many persons shoulders and neck appear to be particularly sensitive to cooling by draft with subjective disagreeable, sometimes *rheumatic*, reactions.

Methods and Apparatus

Conduct of Experiments: The experiments were carried out in a climatized room, in one part of which a cold ceiling was installed (see Fig. 1). Owing to the small size of the room only one subject could be tested at a time. The subject was first placed in the *reference room* beneath the *warm ceiling*, until temperature equilibrium was established on the skin and particularly on the shoulders, neck and other body surfaces exposed to the ceiling (30 to 45 min), after which he was moved beneath the cold ceiling. New temperature recordings were then made until eventually a new temperature equilibrium was reached (60 to 120 min). Along with the subjective statements, the finger and toe temperatures were used as an objective measure as to whether a general reaction to cold (chill reaction) develops. Of the experiments performed, totalling 20 (see Table 1) 7 comprised experiments with naked upper body and with the body at rest, 6 with one layer of clothes (thick working shirt) over the upper part of the body and with the body at rest, and 7 experiments with 2 to 3 layers of clothes (corresponding to normal working clothes) and light manual work (total energy development 150 kcal per hr = 595 Btu per hr) on an ergometer cycle.

Besides these experiments on a model scale, opportunity was pro-

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[†] The investigation was performed at the Climatic Physiological Laboratory, Uppsala University, with financial support from the Swedish Building Research Board.

[*] The Climatic Physiological Laboratory, Uppsala University.

[1] Exponent numerals refer to References.

For presentation at the 64th Annual Meeting of the AMERICAN SOCIETY OF HEATING AND AIR-CONDITIONING ENGINEERS, Pittsburgh, Pa., January, 1958.

vided for an investigation on large factory premises below ground, where use was made of the ceiling cooling system. In this way a practical check on a random test basis was obtained of the laboratory experimental results.

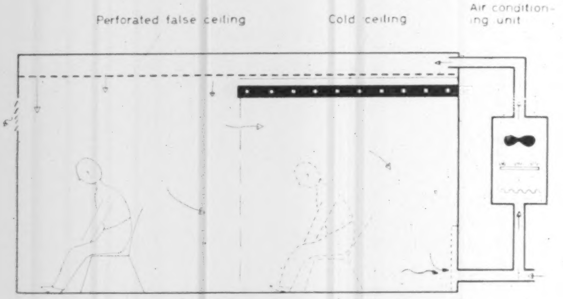

Fig. 1—Sketch of the test arrangements

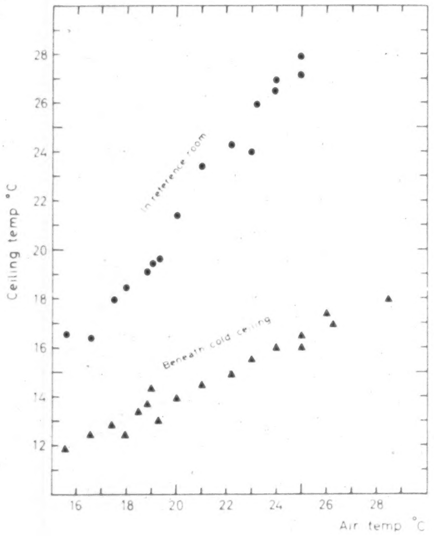

Fig. 2 *(right)*—Relation between ceiling surface temperature and air temperature prevailing in test room

Experimental Apparatus: The climatized room (Fig. 1) was ventilated by an air-conditioning unit for heating and moistening and blowing in the preconditioned air through a perforated false ceiling. The air supply of the room was equivalent to 10 air changes per hour. The amounts of fresh and return air could be varied by damper. The relative humidity was maintained at 55-60 percent for all tests on persons. A cold ceiling, consisting of a concrete slab, 2.8 × 2.0 m (9.2 × 6.5 ft), with pipe coils inset, the piping being about 0.5 m ($19\frac{5}{8}$ in.) apart, was set up independently on posts above part of the test room, 2.1 m (7 ft) above the floor. The pipe coils were fed with cold water at the rate of 13 lit per min (3.4 gpm) the temperature on entering being 8.5 C (47.3 F). The subject was placed beneath the cold ceiling on a chair or a saddle seat 0.9 m (3 ft) above the floor so that the shoulders were exposed to the cold ceiling at the space angle (about 2.2 steradians†) such as would be the case in a workshop with ceiling height of 6 m (20 ft) and width of 11 m (36 ft). A downwardly directed flow of cold air from the cold ceiling could be observed just under the ceiling by the use of titanium tetrachloride fumes. After that, the cold air became entirely mixed with the somewhat rising circulating air. Thus cooling of the subjects due to the downward flow of cold air from the ceiling did not occur to any measurable extent.

Owing to the constant delivery of cold water the underside of the cold ceiling assumed a definite surface temperature for each level of air temperature in the room (see Fig. 2). Thus, with an air temperature of 18 C (65 F) there was a cold ceiling temperature of 13 C (55 F), while the lowest cold ceiling temperature at 28 C (82 F) air temperature was about 18 C (65 F). Condensation occurred on the cold ceiling only if the relative humidity in the premises exceeded 60-65 percent. The vertical temperature gradient beneath the cold ceiling from the floor up to 1 dm (4 in.) below the ceiling surface was comparatively small, less than 2 C deg.

In the reference section of the room, the temperature of the ceiling was equal to or a little higher than that of the air, especially with high air temperatures (see Fig. 2). In the latter cases, temperature gradients up to 8 C deg were measured between the floor and 1 dm below the ceiling. The air temperature figures which follow were measured in the vicinity of the subject by high-speed recording instruments.

Owing to the efficient air exchange the air temperature beneath the reference ceiling and the cold ceiling was practically identical at each experiment.

The 20 complete tests were performed with 5 separate subjects aged from 20 to 35 years.

Measuring Methods: Measurements of temperature in the air, on skin and on room surfaces were taken chiefly with a thermoelectric instrument having an adjustment time of about 2 sec. In some tests, the thermocouples were fixed to the forehead, the shoulders, the neck, between the shoulder blades, to the chest and to the finger-tips by means of tape, but in such a way that the tape did not cover the soldered tip of the thermocouple. By means of a switch it was possible to read any desired thermocouple on the galvanometer. In one case (test 7) the thermocouples were fixed with collodium, but this was found unsuitable, as a local skin reaction arose accompanied by reddening around the place of application. In other cases, the skin temperature measurements were taken at regular intervals by means of a suitable pencil-shaped applicator.

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†The solid angle subtended at the center of the sphere by a portion of the surface whose area is equal to the square of the radius of the sphere.

Besides direct measurements with thermocouples, the surface temperatures of ceilings and clothes were measured by means of a radiation sensitive Moll thermopile which was calibrated and checked by means of a sooted Leslie cube filled with water at known temperature. As the surface temperature of the cold ceiling varied several degrees, according to the location of the measuring point in relation to the underlying cooling coils, the determination of radiation temperature was found to be a more convenient method. For determination of clothing surface temperature the radiation method is decidedly superior to other methods. No correction was made for emission factors of the different surfaces, as both the rough concrete surface and the clothing surfaces may be regarded as having an emission factor very close to 1.0.

Humidity measurements were taken both by calibrated hair hygrometers and by psychrometers.

For the work tests a cycle ergometer with oil pump braking was used to insure a constant and reproducible work intensity. By determining the oxygen consumption by current clinical methods (Krogh's closed method) the load and pedalling speed were so adjusted that the work represented a heat generation of 150 kcal per hr, which corresponds to the heat which a person standing at a workshop bench would generate at light work.

Subjects were asked at regular intervals to state their feeling of warmth or cold according to a special figure scale. As an objective measure of possibly arising general chill reaction the temperatures at the tips of the fingers and toes were mainly used.

Table 1—Survey of tests and test conditions and skin temperatures, after spending 0.5-1 hr in reference room and beneath cold ceiling

Test No.	Subject	Clothes and work	Air C	Ref. ceiling C	Cold ceiling C	Shoulders ref. C	Shoulders cold ceiling C	Fingers ref. C	Fingers cold ceil. C	Remarks
1	A	Upper body, naked at rest	18.8	19.2	13.7	31.0	29.9	..	..	Chill reaction
2	Ae	Upper body, naked at rest	19.3	19.7	13.0	31.3	29.7	..	..	Chill reaction
3	L	Upper body, naked at rest	25.0	27.2	16.0	33.3	31.5	34	33[a]	
4	Lt	Upper body, naked at rest	23.2	26.0	..	33.7	..	32	..	Subjectively indiff.
5	Lt	Upper body, naked at rest	26.0	27.0	17.5	33.8	32.5	34	27	
6	A	Upper body, naked at rest	28.5	35.0	18.0	34.4	33.0	35	34	
6x	T	Upper body, naked at rest	18.5	..	13.5	..	29.2	..	26[b]	
7	Lt	One layer clothing, at rest	16.6	16.3	12.5	32.4[c]	31.5[c]	19	17	
8	Lt	One layer clothing, at rest	21.0	23.5	14.5	32.8	31.3	33	23	
9	Lt	One layer clothing, at rest	23.0	24.0	15.5	33.4	32.0	33	27[d]	
10	S	One layer clothing, at rest	23.2	26.0	..	33.5	..	30	..	
11	Lt	One layer clothing, at rest	26.2	31.0	17.0	34.2	32.6	35	33	
12	L	Two layers clothing, at rest	25.0	28.0	16.5	35.0	34.0	33	32	
13	Lt	2 to 3 layers cloth., at work[e]	15.6	16.6	12.0	32.1	31.7	21	20	
14	Lt	2 to 3 layers cloth., at work[e]	17.5	18.0	12.8	32.0	31.3	30	20	
15	Lt	2 to 3 layers cloth., at work[e]	18.0	18.5	12.5	33.4	33.0	28	24[f]	
16	Lt	2 to 3 layers cloth., at work[e]	20.0	21.5	14.0	33.5	33.5	32	32	
17	Lt	2 to 3 layers cloth., at work[e]	22.2	24.4	15.0	33.3	32.9	35	33	
18	Lt	2 to 3 layers cloth., at work[e]	24.0	26.6	16.0	34.4	33.5	33	33	
19	Lt	One layer cloth., at work[g]	19.0	19.5	14.4	33.0	32.2	30	28	

[a] Chill reaction after 2 hr. [b] Falling; 2-hr test. [c] Local collodium irritation. [d] Subjectively indiff. [e] At the rate of 150 kcal per hr. [f] Falling. [g] At the rate of 225 kcal per hr.

Results

As each test produced a record with 100 or so skin temperature figures, which owing to the different conditions of tests cannot be assembled into group or mean figures, presentation of the entire material is difficult. Table 1 gives a summary of test conditions and of equilibrium figures for skin temperatures on the shoulders and at the fingertips (mean values of right and left sides) at the end of the stay beneath the reference ceiling and the cold ceiling respectively. Changes in finger temperature constitute a criterion for any alterations in the body's total heat balance.

Examples of Recording Curves: Fig. 3 shows the temperatures on one shoulder with the upper part of the body naked during one of the first tests, from which the distinct effect of the cold roof may be seen. Fig. 4 shows the complete temperature record of test No. 3 with air temperature at 25 C (77 F), reference ceiling at 27.2 C (81 F), cold ceiling at 16.0 C (61 F). During the stay in the reference room the heat equilibrium is maintained and is inclined to move towards heat reaction (see toe temperature curve). After moving under the cold ceiling there occurs a momentary fall of the temperatures, particularly in the skin surfaces exposed horizontally to the ceiling, and after about 2 hours a general chill reaction is developed.

Upper Body Naked at Rest: This test series (tests 1-6x) was carried out chiefly to find out whether, in general, the cold ceiling has any influence on the temperature and heat balance. The tests showed clearly that such an influence was present. The cooling effect of the ceiling is particularly pronounced on the shoulders, the neck, the upper part of the back (between the shoulder blades), and on the surface of the hair on the crown of the head; but the temperature on the under-hair was but little affected or possibly only temporarily. The areas mentioned are evidently most exposed to heat radiation towards the cold ceiling with slightly forward inclined body position.

The cooling action of the ceiling makes itself apparent in a temperature fall on the shoulders of 1.5 to 2.5 deg C, counting from the equilibrium figure in the reference room (see Table 1). During the fall of temperature there constantly arose a clear feeling of chill (*draft*) over the shoulders and neck. If the shoulder temperatures reached figures below about 31.5 C (88.7 F), the chill persisted even after the initial steep fall in temperature. In these cases a general chill reaction soon developed with a pronounced drop in temperature at the fingers and toes to levels barely exceeding the air temperature.

It was only at an air temperature of more than 26 C (78.8 F) beneath the cold ceiling, ceiling temperature 17 C (62.6 F), that the shoulder temperatures could be definitely maintained above the critical level. In the reference room, on the other hand, comfortable warmth could be maintained with at least 23 C (73.4 F) air temperature. In the temperature range of 23-26 C for the air, therefore, it was the cold ceiling, for persons with the upper body naked, that was the weight in the scale which brought the body down to negative heat balance with chill reactions as a result.

In some of the aforementioned tests, it was observed that the temperature fall on the shoulders after moving under the cold ceiling was succeeded by a rising shoulder temperature in conjunction with the development of the general chill reaction.

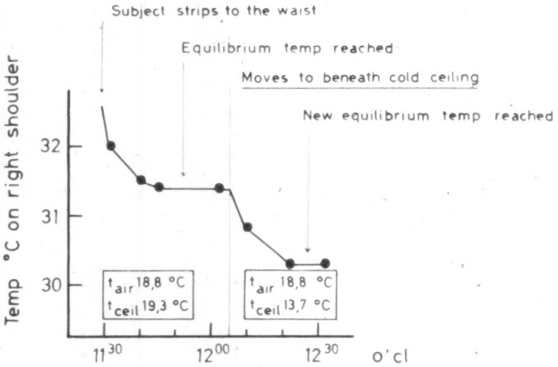

Fig. 3—Example of temperature record on moving to beneath cold ceiling

One Layer Clothes, at Rest: Even in these tests (Nos. 7 to 12) a distinct fall of about 1 C deg in shoulder temperatures occurs after moving under the cold ceiling. The fall in temperature is regularly accompanied by a temporary feeling of draft over the shoulders and neck. Persistent feeling of chill arose only in tests 7 and 8, where the shoulder temperature fell to below 31.5 C (88.7 F). The limiting values for threatening chill reaction in the reference room lay at the air temperature 20 C (ceiling temperature 21 C), but the corresponding figures beneath the cold ceiling were 23 to 23.5 and 15.5 to 16.0 C, respectively.

In several of these tests it was observed that the skin temperature on shoulders, under-hair and neck after the initial fall rose somewhat to an equilibrium value between the initial figure of the reference room and the minimum figure. Fig. 3 is an example of such a reaction (test No. 9). This phenomenon makes it difficult to state an equilibrium value for the skin temperatures after the move to beneath the cold ceiling. The reason for the phenomenon is discussed later.

The temperature of the clothing surface, determined by thermopile, in general varied considerably from one measurement to another—appreciably more than the skin temperature did. The explanation is to be found in the creasing and other displacements of the garment making air layers of different thicknesses between skin and garment. A temperature fall on the clothing surface over the shoulders amounting to 2 to 3 deg C was, however, the most usual effect of moving to beneath the cold ceiling.

The garment consisted in tests Nos. 7 to 11 of a thick working shirt.

Normal Clothing, Light Work: These conditions for the subjects were considered as best agreeing with real conditions which would arise in a workshop with cold ceiling. The clothing on the upper body consisted of under-vest, shirt, and blue overall jacket. The work, as previously stated, was performed on an ergometer cycle at about 150 kcal per hr, corresponding to light manual labor in standing position.

The tests (Nos. 13 to 19) were performed with air temperatures between 24 (75 F) and 16 C (61 F). The results were broadly the following:

At 24 C (75 F): Subjective and objective heat reaction both in the reference room (ceiling temperature 26 to 27 C) and beneath the cold ceiling (ceiling temperature 15 to 16 C), with merely a temporary slight feeling of chill over the shoulders and neck just after moving to beneath the cold ceiling.

At 22 C (71.6 F): Still heat reaction in the reference room (ceiling temperature 24 C), whereas the reaction beneath the cold ceiling (ceiling temperature 15 C (59 F) is more inclined to be indifferent.

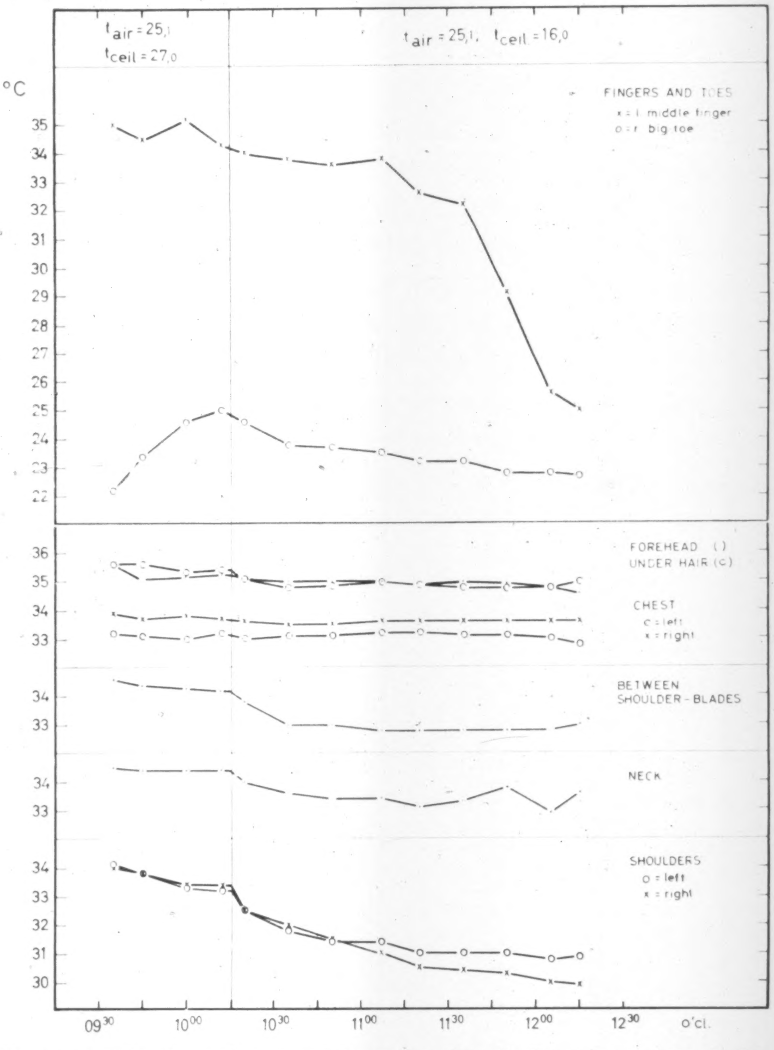

Fig. 4—Example of complete record for a test (No. 3). The move to beneath the cold ceiling took place at 10:15 a.m.

At 20 C (68 F): More or less indifferent in both places, but with rather lower skin temperature beneath the cold ceiling (ceiling temperature 14 C).

At 18 C (64.4 F): Several tests were made at this temperature. In one, heat balance prevailed with agreeable cool sensation in both places, in another the heat balance was maintained in the reference room, whereas a definite chill reaction set in beneath the cold ceiling. In a third test a beginning of chill reaction was noted while in the reference room and this was accelerated after the move beneath the cold ceiling (cold ceiling temperature 12 to 13 C).

At 16 C (60.8 F): The chill reaction sets in before leaving the reference room.

The temperature drop on the shoulders after moving was in these cases less throughout than in the series described earlier, and amounted to from 0.5 to 1 C deg at the most.

Analysis and Discussion of Results

2-Phase Temperature Reaction: The phenomenon observed in some of the tests with first falling and then rising temperature on shoulders and neck after moving to beneath the cold ceiling, as illustrated by Fig. 5, would appear to be capable of explanation in the following manner. To begin with, the temperature of the trunk surface falls on account of the physically caused, increased cooling and soon there develops a general chill reaction with falling finger and toe temperatures (*phase I*). The vasoconstriction in the general chill reaction first affects the peripheral ends of the extremities. The resulting decreased blood circulation in the extremities leads to an increase of circulating blood in the trunk. If the local chill effect on the trunk has not been strong enough to produce maximum vasoconstriction in the skin, this leads also to an increase in blood circulation in the skin of the trunk, with resulting increase of temperature. During this *phase II* (see Fig. 5) there are still falling temperatures on the fingers and toes, but rising temperatures on the surfaces of the trunk.

Based on this explanation, this 2-phase course of the trunk surface temperature would be particularly noticeable with moderate chill reaction, when the vasoconstriction in the skin is chiefly confined to the extremities. This is, indeed, supported by the present test material; it was especially with shoulder temperatures around 32 C (89.6 F) during the first phase that a second phase with rising shoulder temperatures appeared. With greater local temperature fall over the shoulders and stronger general chill reaction the effect was not noticed.

In many of the tests this secondary temperatures increase on the trunk surface was succeeded by a weak feeling of warmth.

Knowledge of this 2-phase reaction is evidently of great significance in all investigations and analyses of local *draft* effects. The difficulty of applying physical cooling equations, at least to isolated parts of the human body, is also illuminated by this.

Journal Section

Air and Ceiling Temperatures in Comfort Chart: In Fig. 6 the results of 2 of the test series (naked upper body at rest, and working clothes with light work) have been combined to make a *comfort chart* with respect to air and ceiling surface temperatures. The temperature on the shoulders is included in the chart as parameter. These *isotherms* have been so drawn as straight lines that they fit best with all the recorded equilibrium values for shoulder temperature. It appears from the test results that a general chill reaction arose in the subjects when the skin temperature on the shoulders fell below about 32 C (89.6 F); with a shoulder temperature of 31.5 C (88.7 F) or lower the chill reaction set in very rapidly, whereas an equilibrium temperature of 32 C (89.6 F) could be maintained for one or a few hours before the manifest chill reaction arose. A shoulder temperature of 32.5 to 33 C was in all tests associated with a subjective feeling of *pleasantly cool*, while shoulder temperatures of 34 C (93.2 F) or over were associated with subjective and objective heat reaction. In none of the tests did subjects reach sweating limit.

From the slope of the *shoulder isotherms* for the conditions *working clothes with light work* it may be seen that the air and ceiling temperatures affect the skin temperature on the shoulders to practically the same extent. The resulting or estimated temperature, therefore, is best obtained as the arithmetical mean of the air and ceiling temperatures. On the whole the chart agrees very well with the chart of *resulting temperature* which Pedersen and Nielsen[8] have recently published for the whole of the human body in a room with different air and radiation temperatures.

Combination Measurements of Air and Ceiling Surface Temperatures: In Fig. 7 is shown the relation between the skin temperature of the shoulders on naked upper body at rest and some separate combination measurements of air and ceiling surface temperatures. The simple arithmetical mean between the air and ceiling temperatures, *i.e.* $(t_a + t_c)/2$, gives the flattest curve, as may be seen. The curve for $(2t_a + t_c)/3$ corresponds to the relation originally given by Pedersen[6] for resulting temperature, while the curve $(t_a + 2t_c)/3$ corresponds to the relation found by Hardy and Du Bois[2]. Recent investigations, both American and Danish, however, have shown that the resulting temperature in general corresponds more to the arithmetical mean of air and radiation temperatures, and this is supported also by

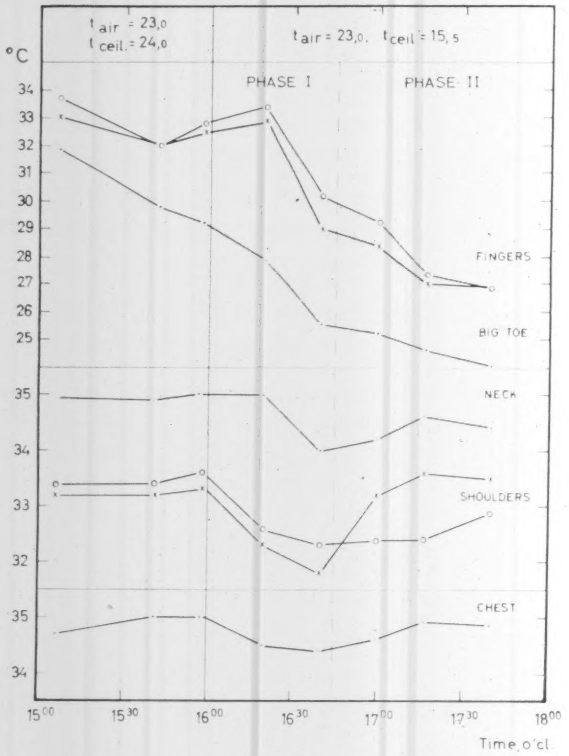

Fig. 5—Example of 2-phase temperature course on surface of trunk as the general chill reaction develops (test No. 9)

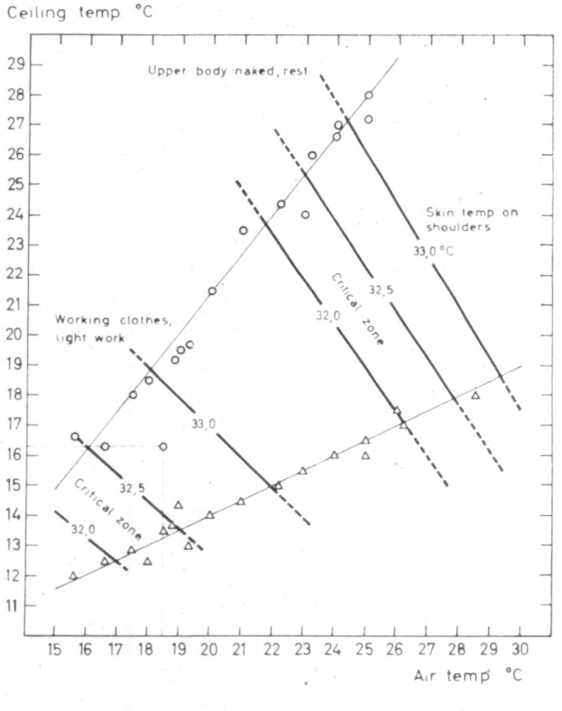

Fig 6—Chart of ceiling surface and air temperatures which gave the same shoulder temperatures in 2 of the test series. A shoulder temperature of 32.5 to 33.0 C was associated with a subjective feeling of *pleasant coolness*

this investigation on limited skin surfaces.

In Fig. 8 the shoulder temperatures for the 2 cases, naked upper body at rest and working clothes with work, are shown against the arithmetically estimated resulting temperature. For shoulder temperatures below about 32.5 C (90.5 F) there prevails, as may be seen, a lineal relation to the weighted temperature. The increased dispersion for tests with working clothes and work would seem mainly to be due to differences in thickness of clothing and insulation from garments.

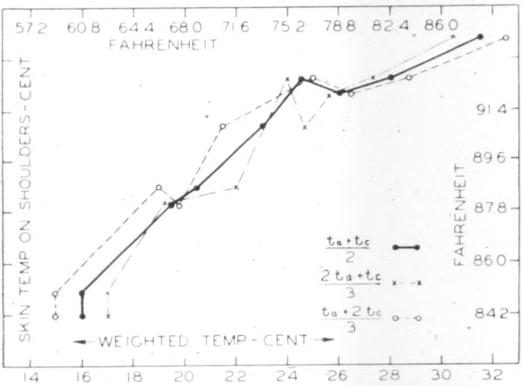

Fig. 7—Correlation between shoulder temperature on naked upper body and different combination measurements of air and ceiling surface temperatures (t_a and t_c). The flattest curve is obtained with the arithmetical mean of the air and ceiling surface temperatures

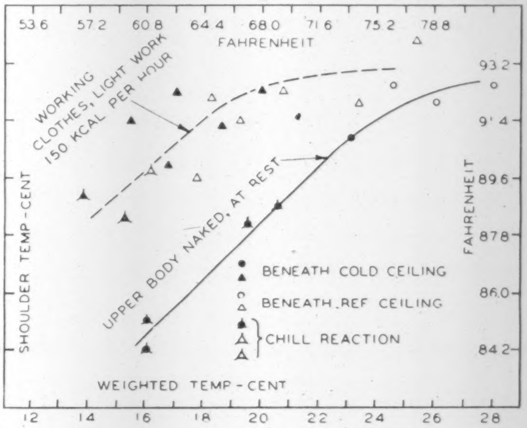

Fig. 8—Correlation between shoulder temperature and mean of air and ceiling surface temperatures

For the tests with naked upper body, there is given in Fig. 9 the relation between the equilibrium values of the shoulder temperature and the difference prevailing at the same time between shoulder temperature and weighted ceiling-air temperature. More distinctly than previously, it stands out there that the temperature curve for the shoulders changes its inclination for a shoulder temperature of 32 to 32.5 C. This is graphically shown on the figure as a *breaking point*. The extent to which this point coincides with the local vasoconstriction or constitutes a sign of incipient arterial precooling, according to Bazett[9], it was not possible to decide with certainty. (It is possible that an arterial precooling mechanism cannot in any case arise on this skin area, owing to the anatomical blood vessel conditions.)

Finally, a comparison has been made in Table 2 of the temperature fall on the shoulders and the difference in temperature between reference ceiling and cold ceiling, for all the tests concerned. Putting aside the tests marked x, where the shoulder temperature did not go down to the linearly falling part of the *cold* side of the critical temperature zone, 32 to 32.5 C, it is then found that a 1 C deg temperature increase on the ceiling means 0.20 to 0.21 deg fall of the shoulder temperature with naked upper body, whereas the corresponding value with a layer of clothes over the shoulders amounts to 0.16 to 0.24 deg and with 2 to 3 layers of clothes to 0.09 to 0.13 C deg.

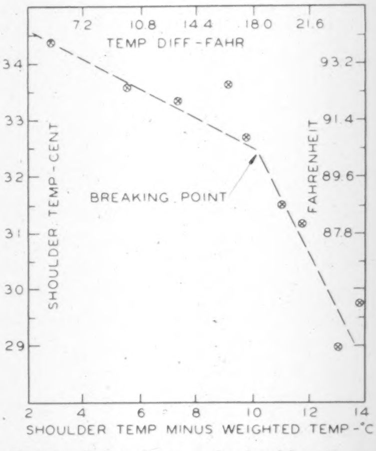

Fig. 9—Dependence of shoulder temperatures on the *external* temperature difference. The altered slope of the relationship line at 32.5 C shoulder temperature stands out clearly

Investigation in an Underground Workshop

Opportunity was provided to verify experimentally on a practical scale the relations found between air and ceiling temperature with ceiling cooling in an underground factory (Svenska Flygmotor, Trollhättan). The premises consist of an 11 m (36 ft) wide main shop with average ceiling height 6 m (20 ft). The space angle of the cold ceiling to a person standing in the middle of the shop would therefore be the same as prevailed for the laboratory tests carried out on a model scale. The ceiling temperature was taken thermoelectrically at 19 separate points, giving a mean value of 16.3 C (61.3 F), while the air temperature was kept to 18.3 C (64.9 F) at breast height above the floor. The subjective sensation of the degree of warmth in the space may best be characterized as *agreeably cool*, with a slight transient feeling of draft over the shoulders and head on coming into the premises. These conditions obviously lie wholly within the comfort zone according to the chart in Fig. 6. On that chart it can be read that these temperature conditions correspond to skin temperatures on the shoulders between 32.5 and 33 C. It may also be seen from the chart that a lowering of the ceiling temperature to about 14 C (57.2 F) requires to be compensated by a raising of the air temperature in the premises to 20 to 21 C to be able to retain the same shoulder temperature. It should, however, be stated that the workers in this workshop are seldom exposed to the cold radiation from the cold ceiling that corresponds to the conditions in the model tests. This is due partly to the fact that the workers are standing as a rule close to one of the walls, which means a smaller space angle to the ceiling, and partly owing to their often being subjected to radiant heat from the machines operating on the premises.

Summary

The influence of the temperature of the ceiling surface (with angle of space at 2.2 steradians) on the skin temperature of the upper body naked and clothed has been studied for air temperatures between 16 (60.8 F) and 20 C (68 F) on subjects at rest and at work. On moving from beneath a warm ceiling to beneath a cold ceiling, a rapid fall of temperature was observed on the body surfaces exposed to the ceiling. If a slight chill reaction developed (falling finger and toe temperatures) there was occasionally observed an increase in temperature of the trunk's surface setting in later. This is assumed to be due to the beginning of displacement of the circulating blood volume from the extremities to the trunk. Good correlation was obtained between the equilibrium values for skin temperature of shoulders and the mean of air and ceiling temperatures. A fall of the temperature of the ceiling surface by 1 C deg led to a fall of shoulder temperature of 0.20—0.24 C deg on naked upper body at rest; 0.16 to 0.24 C deg with one layer of clothes and rest; and 0.09 to 0.13 C deg with 2 to 3 layers of clothes and light work. On the basis of the results attained, a *comfort chart* has been drawn for the ceiling surface and air temperatures which may be expected to give the same shoulder temperatures.

Table 2—Quotient between temperature fall on shoulders (Δt_{sh}) and temperature difference between reference ceiling and cold ceiling ($\Delta t_{ceil.}$)

Test No.	Air temp.	Other conditions	$\Delta t_{ceil.}$	Δt_{sh}	$\frac{\Delta t_{sh}}{\Delta t_{ceil.}}$
1	18.8	Upper body naked, at rest	5.5	1.1	0.20
2	19.3	Upper body naked, at rest	6.7	1.6	0.24
3	25.0	Upper body naked, at rest	11.2	2.3	0.21
5	26.0	Upper body naked, at rest	9.5	1.3	0.14[a]
6	28.5	Upper body naked, at rest	17.0	1.4	0.08[a]
7	16.6	1 cloth. layer, at rest	3.7	0.9	0.24
19	19.0	1 cloth. layer, at rest	5.1	0.8	0.16
8	21.0	1 cloth. layer, at rest	9.0	1.5	0.17
9	23.0	1 cloth. layer, at rest	8.5	1.4	0.16
11	26.2	1 cloth. layer, at rest	14.0	1.6	0.11[a]
12	25.0	2 cloth. layers, at rest	11.5	1.0	0.09[a]
13	15.6	2 to 3 cloth. layers, at work	4.6	0.4	0.09
14	17.5	2 to 3 cloth. layers, at work	5.2	0.7	0.13
15	18.0	2 to 3 cloth. layers, at work	6.0	0.4	0.07[a]
16	20.0	2 to 3 cloth. layers, at work	7.5	0.0	0.0[a]
17	22.2	2 to 3 cloth. layers, at work	10.6	0.4	0.04[a]
18	24.0	2 to 3 cloth. layers, at work	10.6	0.9	0.09[a]

[a] Shoulder temperature on the *warm* side of the critical temperature zone (32 — 32.5C).

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Importance of Industrial Environment

By K. E. Robinson

The term *Industrial Environment* means different things to different people, and the definition that might be agreed upon today could be outdated tomorrow. Not many years ago most people, when discussing the term, were thinking only of the control of toxic air-borne materials. Most of the early work done on the subject was directed by medical doctors, and the plan of action was to determine the toxic material which was causing an occupational illness, and then seek means of controlling it.

It was only 25 years ago that the basic information on the design of hoods was first published by Dalla Valle. Following this, the control of toxic materials has gradually become the responsibility of the engineer. During World War II, the Government assisted in bringing recognition to the problem by insisting that government contracts be fulfilled in plants where all toxic materials were controlled to assure an atmosphere that would not harm the health of the employees.

Comfort Is Demanded

Today the control of toxic materials in industrial plants is an important but almost routine matter. In addition, demands are now being made by labor, management and government agencies for more desirable or comfortable working conditions. The greater need for mechanically controlled environments is also being created by the trend toward automatic plants having thousands or even millions of square feet of floor area covered by powerful closely packed machinery releasing millions of Btu's per hour.

The members of the Technical Advisory Committee on Industrial Environment are familiar with the needs and problems arising in the field, and have accepted the challenge which they present. Work is continuing on both long-term theoretical programs and the everyday problems which face the design and plant engineers. At the present time, cooperative research is being conducted at the University of Pittsburgh, under the guidance of the TAC, to develop more reliable data on lateral exhaust ventilation systems.

Missing Information

Data are also needed on the optimum environmental conditions for men performing various types of work. The ASHAE pioneered in the development of such data for sedentary individuals a number of years ago, and at that time a few tests were made at higher work rates. However, existing data are spotty and unreliable over the range applicable to modern industrial conditions.

Information is also needed on the stresses resulting at conditions other than optimum, for in many industries it may never be possible to create truly comfortable conditions. It then becomes important to know how much work a man can perform under adverse environmental conditions without causing excessive stress or impairment to health. The effect of radiation over the entire range of conditions, including those for the sedentary individual, also needs to be evaluated.

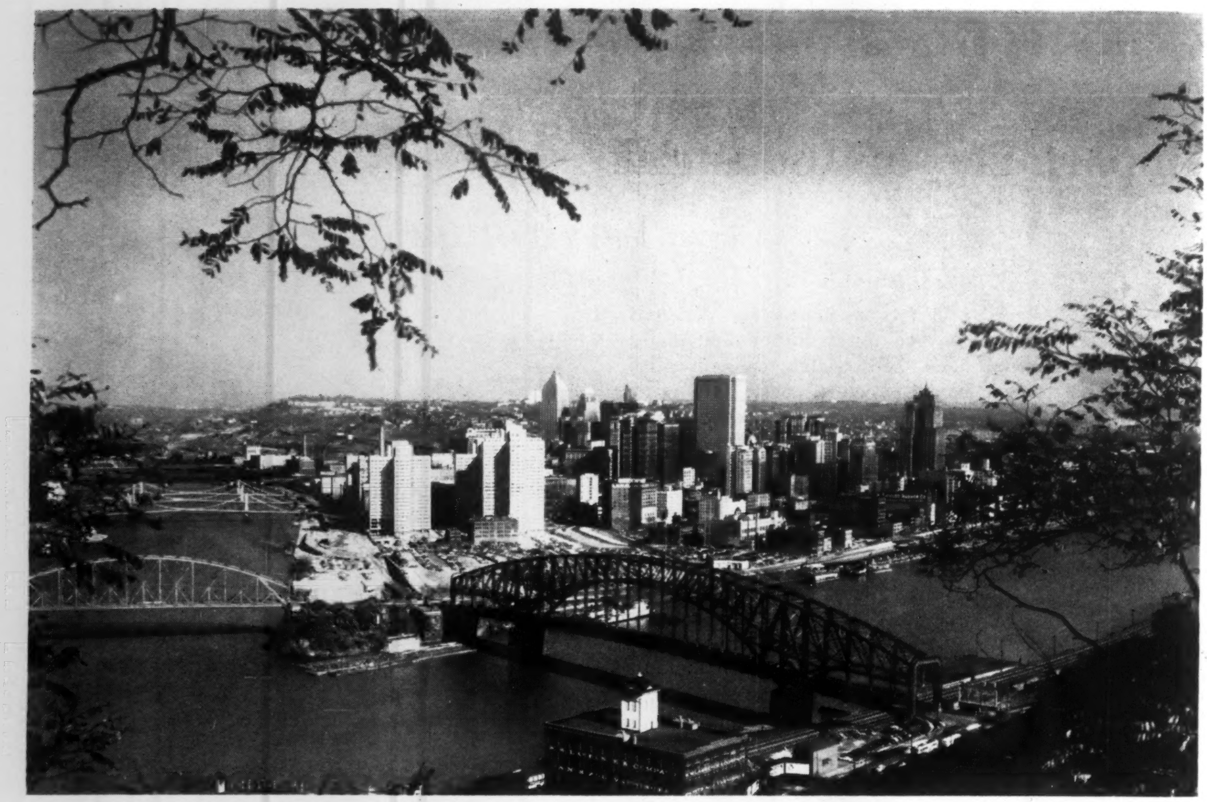
Plans and Interests

The Society's Environment Laboratory in Cleveland is now being remodeled for physiological studies, and it should be ideally suited for the development of the above-mentioned data. Air-conditioning equipment is being installed to control air temperature and humidity over a wide range of conditions, and the temperature of the walls, floor and ceiling may also be varied as desired. The TAC urges that a high priority be assigned to this phase of the physiological studies.

The TAC on Industrial Environment is interested in the wide dissemination of existing data in its field of interest. To do this it has, and will continue, to review material in The Guide relating to the subject and to encourage symposiums and other methods of distributing practical, usable information.

The Committee believes the subject *Industrial Environment* covers a greater area than perhaps any other one subject that is of interest to the Society. This belief was substantiated by the large attendance at the Industrial Ventilation Symposium sponsored by this Committee at the Annual Meeting last February.

The TAC encourages the chapters to consider the interest shown in the field of Industrial Environment and to include discussion of the subject on their programs.



View of Pittsburgh from Mt. Washington

Pittsburgh Plans Progressing

The 64th Annual Meeting of the Society will be held January 27, 28, 29, 1958 in Pittsburgh, Pa., at the Penn-Sheraton Hotel. Nineteen years ago, in 1939, the 20th anniversary of the founding of the ASHAE Research Laboratory at the U. S. Bureau of Mines, Pittsburgh, was celebrated at the 45th Annual Meeting, and in 1943 the Society Semi-Annual Meeting took place in Pittsburgh.

Once more the host chapter for an Annual Meeting, members of the Pittsburgh Chapter are already at work mapping out the preliminary plans for an outstanding Annual Meeting.

Chapter Pres. E. H. Riesmeyer, Jr., has announced that T. F. Rockwell is the general chairman of the Committee on Arrangements, assisted by Vice Chairman D. W. Loucks, with R. B. Stanger serving as honorary chairman.

Committee on Arrangements

Chapter members on the various committees which make up the Committee on Arrangements are:

RESERVATIONS: Dean B. Hicks, *Chairman*
  Get-Together Party, J. H. Llewellyn
  Welcome Luncheon, Edward Claitman
  Banquet, R. M. Toucey
  Entertainment, C. W. Stanger
  Hotel Arrangements, J. F. Fleming
  Tickets, L. B. Wilkes
HOSPITALITY: E. J. Busch, *Chairman*
  Sunday Entertainment, A. J. Meade
  Reception and Registration, R. M. Meucci
  Information and Transportation, W. A. Allen
PUBLIC RELATIONS: B. R. Small, *Chairman;*
  J. N. Riley, *Vice Chairman*
FINANCE: H. Lee Moore, *Chairman;*
  K. W. Stickle, *Vice Chairman*
LADIES: Mr. & Mrs. B. B. Reilly,
  Co-Chairmen
INSPECTION TRIPS: A. F. Metzger, *Chairman*
SESSIONS AND FACILITIES: C. W. Stanger, *Chairman*

In addition to President Riesmeyer, the other chapter officers are Vice Pres. E. J. Busch, Secy. G. E. Smetak and Treas. R. C. Firsching.

Program and Papers

The Program and Papers Committee, John Everetts, Jr., Philadelphia, Pa., chairman, has prepared a program of 8 sessions including 3 symposiums. It is expected that 15 papers will be presented, with one of the sessions possibly a Topical Session on the Utilization of Solar Energy.

The 3 symposium subjects are identified as High-Temperature High-Pressure Hot Water; Aircraft Air Conditioning; and School Heating, Ventilating and Air-Conditioning.

Tentatively there are to be 2 simultaneous morning sessions on Monday, Tuesday and Wednesday with the final 2 sessions running concurrently on Wednesday afternoon.

As is customary, the Council and various committees will meet during the period, January 25 through January 29. The organization meeting of the 1958 Council will be on Thursday, January 30.

The Meeting City

Visitors to Pittsburgh for the first time, or after an absence of some years, will discover that a great reconstruction project has and is transforming downtown Pittsburgh. The Golden Triangle and the historic Point at the junction of the Allegheny and Monongahela Rivers have been cleared; a 36-acre park covers the site where Fort Pitt, frontier outpost, once stood. On the adjoining 23 acres, several multi-story buildings have been erected. Visiting the new Pittsburgh will be a thrilling experience.

CANADIAN POWER SHOW FOR TORONTO

It has been announced that after a 4-year absence Canada's Power Show is to be held October 21-24 in the new Queen Elizabeth Building in the Canadian Exhibition Grounds at Toronto.

This ultramodern structure is to be completed shortly before the opening date of the meeting. In addition to the enlarged exhibition area, the building includes a theater and ample eating facilities. It is also located close to the hub of the city in the downtown area.

Running concurrently with the 4-day exhibition, it is planned to have technical sessions with various engineering societies taking part. Our Society has plans for exhibiting at the Show, making use of an exhibit essentially similar to the one used at the 13th International Heating and Air-Conditioning Exhibition at Chicago last February.

It is expected that the Show will draw a large attendance, and it is suggested that members who plan on going should complete plans for doing so at the earliest possible date.

REED GOES TO ARI

A long-time member of the Society, F. J. Reed, professor of mechanical engineering at Duke University, recently was appointed to the newly-created post of chief engineer of the *Air-Conditioning and Refrigeration Institute*. He assumed his new duties during July.

In addition to activities in connection with *ASRE*, Professor Reed has taken an active part in the work of our Society, being a past president of the North Carolina Chapter and having contributed importantly to The Guide.

ENVIRONMENTAL INSTITUTE AT LOS ANGELES

A 2-day meeting is announced for September 13 and 14 of the *Environmental Control Institute* to be held at the UCLA campus in Los Angeles.

Several Society members are taking an active part in the program. Dean L. M. K. Boelter of the School of Engineering, University of California, is to be the keynote speaker with his announced subject being *Man's Effort to Control His Environment.*

The general committee arranging for the Institute is headed by Leo Hungerford, Los Angeles, who is a past president of the Southern California Chapter. Past Pres. J. E. Haines, Minneapolis, Minn., is also on the list of speakers for the Institute.

The Institute is arranged for presentation of prepared papers and for sessions devoted to panel discussions. Generally, the theme of the program is to integrate the existing knowledge of indoor climate.

GORDON AT EJC

As the Society representative to the Engineers Joint Council, Pres. P. B. Gordon, New York, N.Y., attended the recent meeting of the Executive Committee of the Council held in New York. This is the first year that the Society has held membership in the Council.

CONFERENCE ON BOILER-BURNER UNIT TESTING

Eighteen representatives of industry, trade associations, and government agencies interested in testing, rating, and performance of heating boilers equipped with burners for oil, gas, or coal attended a conference at the ASHAE Research Laboratory in Cleveland on July 16.

The meeting which was held under the auspices of the ASHAE Standards Committee, with Mr. Keith Davis, chairman, presiding, was called for the purpose of determining the need for a test standard for rating factory-built boiler-burner units.

The need for establishing a standard terminology referring to *loads, ratings, outputs* and similar words was evident from the discussion. The conference recommended that a study be made of the adequacy of existing test standards and of the allowances that are proper for piping and pickup heat requirements in heating installations.

NEW WELDING HANDBOOK

Publication of the first section of the fourth edition of the Welding Handbook has been announced by the *American Welding Society*.

This section covers the fundamentals of welding and is said to be the most comprehensive work on welding ever published by that Society.

Copies are available at $9.00 per volume from the *American Welding Society*, 33 West 39 St., New York, N.Y.

NEW BOILER AND AIR CONDITIONING ASSOCIATION FORMED

Word has been received that the *Boiler and Air Conditioning Manufacturers Association* has been organized with F. R. Attwood as president, and G. H. Koven as vice president; M. C. Turpin, for many years executive secretary of *ASRE*, has been appointed executive secretary of the new association.

One of the purposes of the newly formed organization is to establish nonrestrictive test codes and ratings for heating and air-conditioning equipment.

AD FEATURES FARR

In 2-page advertising spreads, General Motors Corp. has been devoting considerable space in various consumer publications to examples of how GM works advantageously with small businesses.

In a recent issue of the *Saturday Evening Post*, one of these spreads featured Farr Co., El Segundo, Calif. President of this company is R. S. Farr, member of the Society; chief engineer is S. F. Duncan, also a member of the Society.

Not only did the copy in the advertisement tell the story of the Farr Co., but a very attractive photograph displayed Mr. and Mrs. R. S. Farr with their 5 children, as well as the general manager of the company, M. S. Farr, with Mrs. Farr and their 4 children.

ASTM HAS 60th ANNUAL MEETING

The subject of water and some of its uses occupied an important place in the program of the 60th Annual Meeting of *ASTM* in Atlantic City, June 17-21. The Edgar Marburg Memorial Lecture was presented by Dr. Everett P. Partridge, Pittsburgh, Pa., on *Your Most Important Raw Material—Water.*

Dr. Partridge pointed out that water is a basic material required for the operation of every industry. Short in supply in various parts of the United States, water actually is plentiful over the country as a whole. Unlike rapidly decreasing resources of minerals and fossil fuels, fresh water is supplied year after year as rain and snow at a rate approximately seven times its total use. The problem is to catch, store, and transport it to the regions where it is needed. Then it must be used and re-used efficiently.

What must be done to prepare water for industry depends on the way it is to be used. Ultra-pure water containing no more than 50 parts per billion of total impurities may be specified for a once-through boiler, while the effluent from a municipal sewage plant serves satisfactorily for cooling equipment in a great steel mill.

While Dr. Partridge did not discuss the use of water in connection with air conditioning, it is interesting to note that the lecture as a whole has an important relation to the use of water for that purpose.

ACTIVITIES OF SOCIETY CHAPTERS

The leading chapter story this month covers the Chapter Organized at Jacksonville. Reports on chapter meetings noted Past Presidents Highlighted and New Chapter Officers. Technical Programs were in the majority, but a few were Not Quite So Serious.

Chapter Organized at Jacksonville

On Tuesday, July 9, the Jacksonville, Fla., Chapter of the Society received its charter. Presiding at the presentation was Pres. P. B. Gordon, New York, N.Y. President Gordon was also the principal speaker at the dinner which preceded the installation ceremonies. He chose as his subject *Our Bottleneck—Technical Know-how*.

The Chapter was inaugurated with a membership of more than 80 as announced at the charter meeting in the Roosevelt Hotel.

As a regular order of business following the receipt of the charter, the charter members joined in electing permanent officers for the current year. B. J. Saymon became *president;* J. R. Spence, *vice president;* G. A. Israel, Jr., *secretary;* W. P. Sherman, *treasurer*. The same group will act as board of governors for the Chapter as it starts its operation.

In accordance with the long-established custom, the Forth Worth, Tex., Chapter, chartered last January, presented the new Jacksonville, Fla., Chapter with a Texas-style gavel.

Present also at the installation ceremonies was C. B. Gamble, New Orleans, La., Society regional director for Region 5, which includes Jacksonville. Mr. Gamble also spoke at the meeting on the general subject *The Value of Society and Chapter Membership*.

Past Presidents Highlighted

The past presidents of the MICHIGAN Chapter in attendance at a recent meeting were introduced by Pres. J. N. Livermore. W. T. Harms, senior past president, addressed the meeting, as did E. M. Harrigan, a past president and one of the founders of the Chapter. • • • Past president's plaques were presented to 2 SOUTHERN CALIFORNIA Chapter members, W. H. C. Ness ('34) and C. D. Walz ('54).

Technical Programs

FORT WORTH and NORTH TEXAS Chapters held a joint meeting at which W. O. Jones, who is associated with the Dallas-Fort Worth Turnpike Authority, revealed some of the history and startling figures related to the turnpike. Mr. Jones headed a firm of engineers whose duty was to design and supervise construction of the 6 sections. In the 30-mile toll road, there are 62 bridges, 130 utility crossings and 6 traffic interchanges. Prior to construction, the speaker explained, the Turnpike Authority made 161,000 personal interviews, plus countless travel and distance surveys. • • • *New Trends in Automatic Controls* were surveyed by a MICHIGAN Chapter speaker, H. W. Alyea, chief field engineer, Johnson Service Co., Milwaukee, Wis. Giving considerable advice on various phases of control installation, he noted that a system of controls is dependent on the type of building and the size of the area to be controlled. • • • SACRAMENTO VALLEY Chapter scheduled brief talks by Michael Kieffer, who discussed corrosion from an electrolytic angle, and by F. E. Hawley, Division of Architects, State of California, Sacramento, who treated the origin and use of refrigerants, with particular reference to Refrigerant-12 and Refrigerant-22. The Chapter also featured a panel discussion on *Refrigeration*, with E. C. McKinsey, chief mechanical engineer, Sacramento District, Corps of Engineers, acting as moderator. The panel consisted of M. J. Delavan, assistant mechanical engineer, heating and air-conditioning department, Luppen & Hawley, Inc.; Maurice Laks, mechanical engineer, also with Luppen & Hawley; and K. C. Sanford, mechanical engineer, associated with L. A. O'Meara, consulting engineer. The discussion by the 3 Sacramento engineers was well received. • • • An interim report of the Committee on Cost Analysis was presented by a SOUTHERN CALIFORNIA Chapter speaker, J. E. Denton, chief mechanical engineer, Van Dyke & Barnes, Los Angeles. Conclusions on various costs and areas covered were drawn from about 15 reports received. A lively discussion concluded the program.

Not Quite So Serious

At a BRITISH COLUMBIA Chapter meeting, R. W. Hole introduced the guest speaker, Herb Capozzi, general manager of the B. C. Lions Football Club, who gave a humorous talk on the Club. • • • NEW MEXICO Chapter held its annual summer party for members, their families and guests at the La Pasada in Santa Fe. A very relaxing and enjoyable time was had by all who attended. • • • Archibald Mull, attorney, described his trip to Europe for the benefit of a SACRAMENTO VALLEY Chapter audience. He particularly mentioned his reaction to the Russian people.

New Chapter Officers

Pres. D. W. Thomson, BRITISH COLUMBIA Chapter, invited Past Pres. S. C. Gale to preside over the installation of new officers. The incoming slate includes: *President*—A. C. Martin; *Vice President*—S. W. Welsh; *Secretary*—W. F. Wiggins; *Treasurer*—D. B. Leaney; *Board of Governors*—R. W. Hole and R. E. Atkey. • • • Installation of the MICHIGAN Chapter officers was conducted by Past Pres. R. H. Oberschulte. The new officers are: *President*—P. S. Hosman; *Vice President*—K. J. Wagoner; *Secretary*—J. B. Olivieri; *Treasurer*—C. J. Henstock; *Board of Governors*—R. E. Maund, J. G. Black, Jr., and R. E. Strand. Following the installation ceremony, G. D. Winans presented the past president's plaque to J. N. Livermore, the retiring president. • • • A unanimous vote was cast for the following members who will serve the SACRAMENTO VALLEY Chapter for the coming year: *President*—M. J. Delavan; *Vice President*—J. A. White; *Secretary*—R. T. Andrews; *Treasurer*—G. F. Romack; *Board of Governors*—V. W. Thornburg, W. B. Lander and R. J. McKinnon.

CANDIDATES FOR MEMBERSHIP

Listed here are the names of 73 men who are candidates for membership or advancement in membership grade.

Members are requested to assume their full share of responsibility of receiving these candidates into membership by advising the Executive Secretary before September 30, 1957, of any whose eligibility for membership is questioned. Unless such objection is made these candidates will be voted upon by the Council.

Note: *Advancement †Reinstatement

Alabama (*Region* 5)

PAYNE, F. T., Engr. in Charge of Const., James A. Evans, Birmingham.

California (*Region* 4)

BARAGAR, J. S.†, Sales Engr., Norman S. Wright & Co., Los Angeles.

CASTLE, G. D., Dir. Engrg., Standard Air Conditioning Corp., Los Angeles.

COMEAU, G. J., Cons. Mech. Engr., Los Angeles.

FELLOWS, R. C., Physical Planning Engr., IBM Corp., San Francisco.

HUTCHINSON, B. L., JR.*, Chief Estimator, Lohman Bros., Los Angeles.

Palacios, F. M., Mech. Engr., General Services Administration, San Francisco.

Colorado (*Region* 3)

Crellin, J. L., Sales Engr., McCombs Supply Co., Denver.

Culman, L. P., Sales Engr., Johnson Service Co., Denver.

Jardine, D. M., Mech. Engr., Douglas Jardine Co., Colorado Springs.

Payne, R. L., Jr., Repr., McCombs Supply Co., Denver.

Rush, H. S., District Engr., Carrier Corporation, Denver.

District of Columbia (*Region* 5)

Stephens, R. L., Supervisory Mech. Engr., U.S. Army, Office Chief of Engineers, Washington.

Florida (*Region* 5)

Breedlove, C. E., Chief Engr., Tompkins-Beckwith, Inc., Jacksonville.

Fletchall, O. H., Owner, Illingworth Engineering Co., Jacksonville.

Howard, D. L.*, Sales Engr., Carrier Corporation, Miami.

Georgia (*Region* 5)

Young, E. F., Cons. Engr., Savannah.

Illinois (*Region* 2)

Carney, B. C., Sales Engr., The Trane Co., Chicago.

Clay, R. J., Engr., Kroeschell Engineering Co., Chicago.

Zimmerman, F. C., Sales Engr., The New York Blower Co., Chicago.

Indiana (*Region* 2)

Mitchell, M. E., Vice Pres., Sales, Weil McLain Co., Michigan City.

Walden, G. B., Jr., Dept. Head, Mech. Engr., Eli Lilly & Co., Indianapolis.

Yaeger, J. V., Sales Engr., Anning Johnson Co., Indianapolis.

Massachusetts (*Region* 1)

Betterley, E. W., Pres., Cellite Engineers, Inc., Springfield.

Campbell, Edward, Jr., Sales Engr., Metropolitan Pipe and Supply Co., Cambridge.

Hanna, W. T., Engr. & Estimator, Park I. Davis Co., Dorchester.

Hanscom, G. L., Mech. Engr., Metcalf & Eddy, Boston.

Walker, R. F., Mgr., R. F. Walker Assocs., Newtonville.

Michigan (*Region* 2)

Sabatini, J. N., Plant Engr., Chrysler Corp., Engineering Div., Highland Park.

Mississippi (*Region* 5)

Curtis, T. V.†, Mfrs. Agt., Jackson, Miss.

Riordan, Eugene, Sales Repr., American-Standard, Jackson.

Missouri (*Region* 3)

Stuhlman, W. F., Engr., Ferris & Hamig, St. Louis.

New Jersey (*Region* 1)

Frankwich, V. T., Sales Engr., J. J. Nesbitt Co., East Orange.

New York (*Region* 1)

Crimp, G. B., Sr. Mech. Engr., Office of Comptroller, City of New York, New York.

Finley, J. H., Jr., Head, Plant Engineering Section Facilities Dept., Cornell Aeronautical Laboratory, Inc., Buffalo.

Gisonda, B. A., Vice Pres., Bartholomaus & Associates, Inc., New York.

Hildebidle, J. J., Vice Pres.-Sales, International Heater Co., Utica.

Roher, Adolph, Engr., Voorhees, Walker, Smith & Smith, New York.

Shulak, John, Mech. Engr., Cowell & Robinson, New York.

Ohio (*Region* 2)

Koberstein, E. J., Mech. Engr., Chevrolet Div., General Motors Corp., Toledo.

Lunt, R. F.*, Sales Engr., Iron Fireman Mfg. Co., Cleveland.

Miller, J. J., Htg. & Vtg. Draftsman, Gulf Oil Corp., Toledo.

Pennsylvania (*Region* 1)

Baumgardner, J. E., Lab. Technician, National-U.S. Radiator Corp., Johnstown.

Goldenberg, David, Prod. Engr., National-U.S. Radiator Corp., Johnstown.

Haas, E. C., Asst. Comptroller, National-U.S. Radiator Corp., Johnstown.

Haas, J. C., Exec. Asst. to the Pres., National-U.S. Radiator Corp., Johnstown.

Hoy, R. A., Dir. of Purchasing, National-U. S. Radiator Corp., Johnstown.

Johnson, R. B., Owner, Johnson's Heating & Air Conditioning, Johnstown.

McFeaters, D. W., Group Leader-Drafting, National-U.S. Radiator Corp., Johnstown.

Milazzo, A. L., Equip. Inspector, Bethlehem Steel Co., Johnstown.

Rigby, F. E., Owner, Bryant Rigby Co., Johnstown.

Semple, J. B., Sales Engr., Dravo Corp., Philadelphia.

Sobieski, J. F., Owner, Joe F. Sobieski Co., Johnstown.

Straub, B. C., Comptroller, National-U.S. Radiator Corp., Johnstown.

Van Doornevelt, R. J., Proj. Engr., Philco Corp. (Advanced Studies), Philadelphia.

Texas (*Region* 6)

Haelig, W. H., Jr., Indus. Insulation Sales Engr., The Armstrong Cork Co., Dallas.

Knape, H. O., Owner, Harold O. Knape and Co., Dallas.

Pratt, O. L., Sales Mgr., A-C. Refrig. Div. Fluor Products Co., Dallas.

Stayner, R. L., Sales Engr., Boyd Engineering Co., Inc., El Paso.

Utah (*Region* 4)

Tregeagle, V. Q., Partner, Redd & Tregeagle, Salt Lake City.

Virginia (*Region* 5)

Bergman, H. L., Associate, Silver Assocs., Norfolk.

Calvert, R. C. M., Jr., Cons. Engr., R. C. M. Calvert, Jr., & Assocs., Warwick.

Canada (*Region* 7)

Anderson, A. C., Vice Pres., Anderson Plumbing Co., Ltd., Calgary, Alta.

Bradley, H. B., Mgr., Furnac-Aire Sales Calgary, Ltd., Calgary, Alta.

Brown, H. M., Proj. Supvsr., Canadian Comstock Co., Calgary, Alta.

Camden, G. A., Repr., American Standard Products (Canada) Ltd., Calgary,, Alta.

Gray, W. T., Designer, Air Devices, Ltd., Toronto, Ontario.

Kennedy, G. W., Partner, K & A Engineering, St. John, N. B.

Taylor, C. W., Mgr., Western Heating, Ltd., Calgary, Alta.

Watson, E. H., Engr., Trotter & Morton, Ltd., Calgary, Alta.

Watson, F. M., Com. Supvsr., Honeywell Controls, Ltd., Leaside, Ontario.

England

Holtum, P. W., Sr. Engrg. Asst., British Railways, Western Region, London.

Iceland

Jensson, R. I., Mech. Engr., Einarsson & Palsson, Reykjavik.

OBITUARIES

ALBERT E. BASTEDO

Irvington, N. Y.

Albert E. Bastedo, an active member of the Society for thirty-eight years, died suddenly on July 11 at his home in Hastings-on-Hudson, at the age of 69. Mr. Bastedo was senior vice president and treasurer of the Burnham Corp., Irvington, N.Y., and served as manager of the Boiler Division of the company. He was also a member of the board of directors of the Corporation.

Associated with the Burnham firm for fifty-one years, Mr. Bastedo first joined Lord & Burnham Co. as a junior clerk in 1906, progressing later to manager of the boiler department. He was active in the formation of the Burnham Boiler Corp. in 1919 and acted as its first manager. He maintained his position as manager of the Boiler Division when the Burnham Boiler Corp. and Lord & Burnham Co. were merged in 1947 into the present Burnham Corp.

The Society honored Mr. Bastedo with Life Membership in 1953. He was also active in *The Institute of Boiler and Radiator Manufacturers,* having served frequently as a member of the executive committee. He was chairman of the Institute in 1945-46.

Diamond Lodge, Free and Accepted Masons, named him a life member. He was a member of the Reformed Church of Hastings-on-Hudson, the city of his birth.

Surviving are his wife, Marion; a son, Edward H., Bellevue, Wash.; a daughter, Mrs. Robert Paterson, Albany, N.Y.; and six grandchildren.

JAMES EMMETT, JR.

Skokie, Ill.

James Emmett, Jr., 52, vice president in charge of sales, Jas. P. Marsh Corp., Skokie, Ill., died on June 7 of a heart attack. Death occurred while he was en route to his home in Hinsdale, Ill., following a business trip to Texas.

Mr. Emmett was born in Burnley, England, and attended Cambridge University. After joining the Jas. P. Marsh Corp. in 1926, he was active in their Sales Division for over thirty years. In 1939, he became division manager in charge of the Middle West, South and Southwest. He later was named general sales manager, advancing to the office of vice president in charge of sales in 1955.

In addition to membership in the Society which he held since 1946, Mr. Emmett was a past president of the *Air-Conditioning & Refrigeration Institute,* remaining active as one of its directors until the time of his death. He had been a fellow of the *Royal Society of Arts* and an associate of the *Royal Photographic Society.*

He is survived by his wife, Eugenia; two sons, James Emmett III and Richard; his daughter, Mary; and parents, Mr. and Mrs. James Emmett, Magnolia Springs, Ala.

AMERICAN SOCIETY OF HEATING AND AIR-CONDITIONING ENGINEERS

(For most recent listing of Society officers and committee personnel see Frontispiece, JOURNAL SECTION*)*

Committee on Research and Its Technical Advisory Committees

The research program of the Society is under the guidance of the Committee on Research — a General Committee — elected by the vote of Society membership. That Committee appoints Technical Advisory Committees as necessary and directs their activities. Listed below are the names of the current members of these committees.

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E. F. Snyder, Jr., Vice Chairman

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Two years: F. H. Faust, F. K. Hick, M.D., R. C. Jordan, H. A. Lockhart, Arthur Nutting.

Three years: D. D'Eustachio, E. S. Howarth, H. R. Limbacher, E. F. Snyder, Jr., J. I. Trimble.

Executive

H. A. Lockhart, Chairman; E. F. Snyder, Jr., Vice Chairman; B. H. Jennings, R. C. Jordan, H. R. Limbacher.

Long-Range Research Program

E. F. Snyder, Jr., Chairman; N. B. Hutcheon, Vice Chairman; R. C. Chewning, F. H. Faust, R. C. Jordan.

Joint IES-ASHAE Task Committee

IES Representatives: Walter Sturrock, Chairman; R. W. McKinley, E. H. Salter. **ASHAE** Representatives: A. T. Jorn, J. N. Livermore, J. P. Stewart.

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*Member of Committee on Research.

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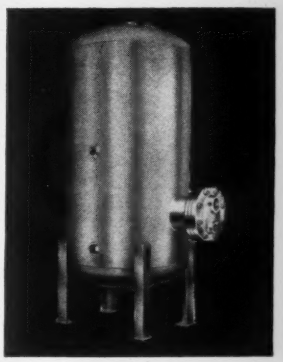

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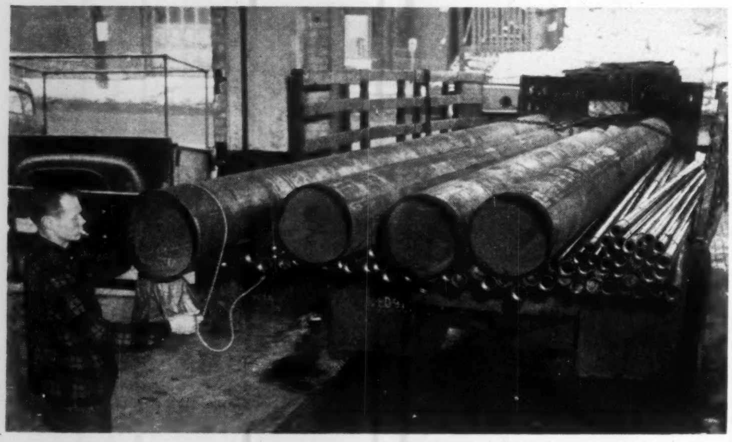

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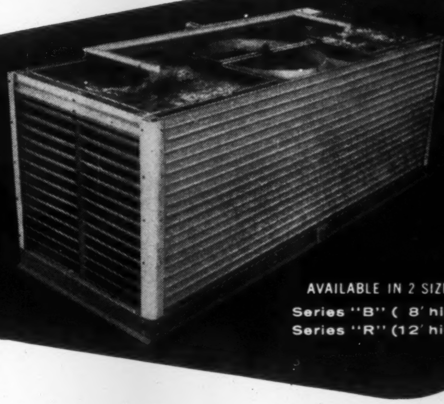

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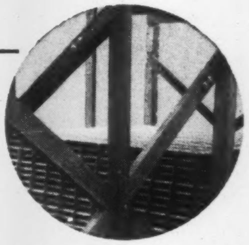
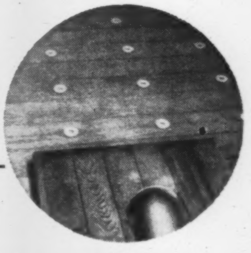
FEATURES

Give You More for Your Cooling Tower Dollar!



ALL HEART REDWOOD FRAMEWORK

Here is framework designed to withstand windloads of 100 mph (30 lbs./sq. ft.). The same heavy cast iron connectors used in the largest Pritchard industrial towers are used throughout. This rugged framework is built to last and last.

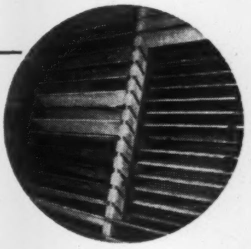


FUNCTIONAL, ATTRACTIVE EXTERIOR

The corrugated asbestos cement board casing used on the LoLine has horizontal corrugations which further enhance the low silhouette of both the Series "B" (8' high) and the Series "R" (12' high) tower. Casing is securely bolted to the framework and corners are covered with asbestos cement corner rolls.

TROUBLE-FREE DISTRIBUTION SYSTEM

This open distribution system results in low pumping head requirements. Removable ceramic orifices distribute water uniformly over the Redwood filling.



SIMPLE, RUGGED FILLING AND DRIFT ELIMINATORS

Only Clear All Heart Grade Redwood is used in the nailless filling of the LoLine. This filling offers efficient breakup of water with minimum resistance to air flow. The drift eliminators effectively remove water from the discharge air.

WANT ALL THE FACTS...
Plus Complete Engineering Data?

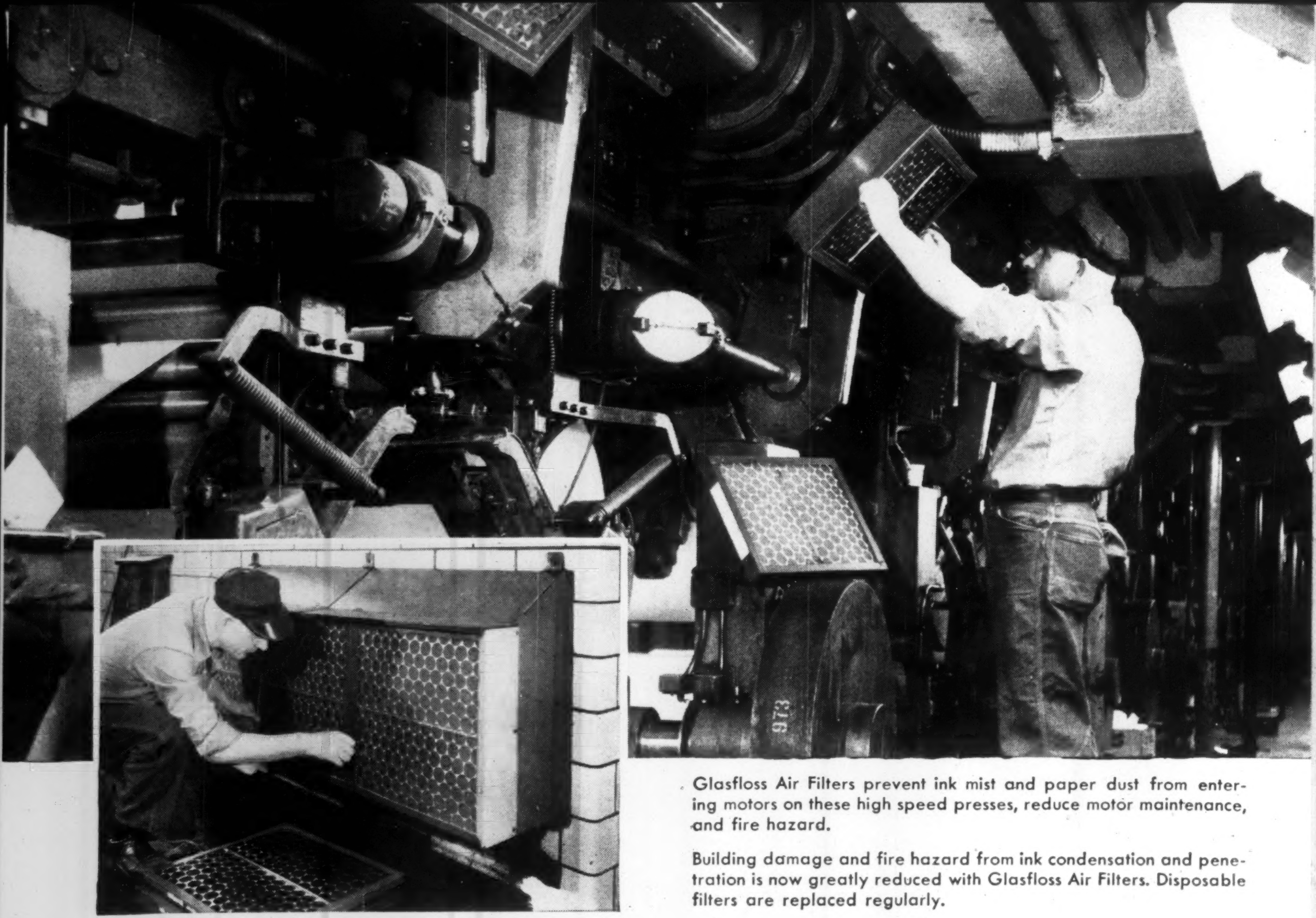
The new, LOLINE Bulletin (No. 5.1.902) is a unique brochure—now you can have all the information you want from one convenient source. Mechanical and structural features are explained, complete engineering drawings and capacity tables are included. You can get your free copy by writing today on your company letterhead—no obligation, of course.

INDUSTRY'S PARTNER FOR PROGRESS

COOLING TOWERS
GAS & AIR TREATING EQUIPMENT

REPRESENTATIVES
IN PRINCIPAL CITIES
FROM COAST
TO COAST

J.F. Pritchard & Co.
OF CALIFORNIA
A DIVISION OF J. F. PRITCHARD & CO.
Dept. 589, 4625 Roanoke Parkway, Kansas City 12, Mo.



Glasfloss Air Filters prevent ink mist and paper dust from entering motors on these high speed presses, reduce motor maintenance, and fire hazard.

Building damage and fire hazard from ink condensation and penetration is now greatly reduced with Glasfloss Air Filters. Disposable filters are replaced regularly.

Glasfloss* Air Filters lessen press maintenance, reduce ink mist hazard at Rochester Times Union

The Rochester Times Union, Rochester, N.Y., had two serious problems common to most newspaper plants, according to Mr. Arnold J. Cunningham, the newspaper's building superintendent.

1. Ink mist and paper dust from 15 press-unit drive motor intakes required the cleaning of internal motor parts every three months. This caused production delays, and thorough cleaning was not always possible. *Solution:* Glasfloss Fiber Glass Air Filters were installed on special frames. Now motor cleaning is done only once every six to eight months, and less time is required. Light vacuuming of filter faces daily allows maximum air intake. Motor operating temperatures are lower and a fire hazard is reduced.
2. Ink condensing inside the air ducts created an extreme fire hazard and ink-spot damage to ceilings and equipment. Paper dust caused extreme surface loading and this impeded the passage of ink mist through the filter. *Solution:* After extensive testing of many filtering devices, Glasfloss Filters proved to be the most satisfactory. Through regular rotation and replacement of filters, the fire hazard has been greatly reduced. Building damage from ink condensation and penetration is very slight. Filtering costs are at a minimum.

GLASFLOSS AIR FILTERS CAN HELP YOU, TOO!

Pittsburgh Glasfloss Air Filters are made from fine, soft fiber glass which provides a greater, more efficient dirt-and-dust-collecting area. Glasfloss Filters are soft and easy to handle; this fiber glass will not splinter or pierce the skin.

Get top results with Glasfloss Air Filters. Write for the name of your nearest Glasfloss distributor. *Pittsburgh Plate Glass Company, Fiber Glass Division, One Gateway Center, Pittsburgh 22, Pennsylvania.*

*Trademark

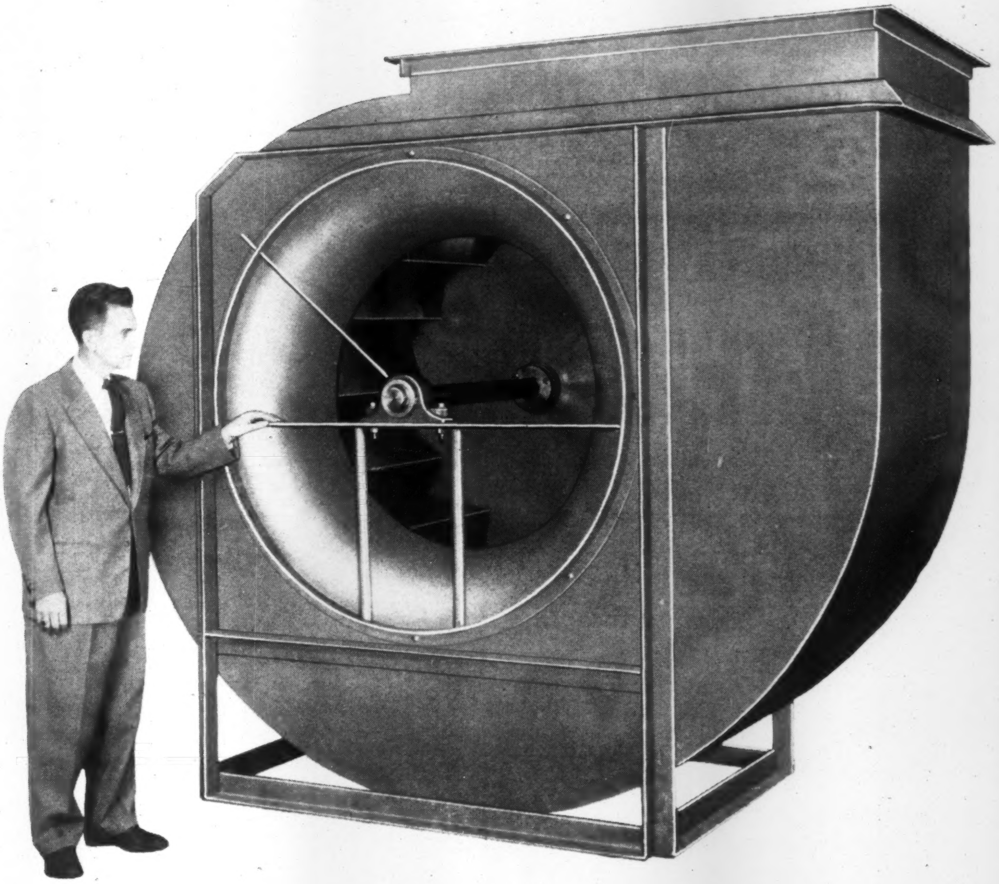
GLASFLOSS FILTERS ARE A PRODUCT OF THE FIBER GLASS DIVISION OF PITTSBURGH PLATE GLASS COMPANY

Sales Offices are located in the following cities: Charlotte, Chicago, Cincinnati, Cleveland, Detroit, Houston, Los Angeles, New York, Philadelphia, Pittsburgh and St. Louis

FIBER PPG GLASS

PAINTS · GLASS · CHEMICALS · BRUSHES · PLASTICS

PITTSBURGH PLATE GLASS COMPANY



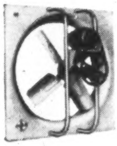
BIG BLOWERS ARE BIG BUSINESS WITH PEERLESS

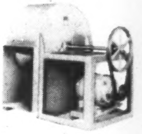
QUIET! • TROUBLE-FREE! • DEPENDABLE! • HEAVY DUTY! • GUARANTEED!

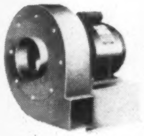
Versatility in size, application, and engineering has always been a Peerless strong point. Peerless builds its own motors and matches them to the specified blower requirements. Peerless blower frames and housings are usually heavier than any competitive products. Result—a quiet, vibration-free unit.

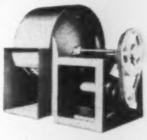
These are not "off-the-shelf" units, but built to customer rotation and discharge specifications. Each one receives 100% inspection before it leaves the Peerless factory. Each unit is built to NAFM standards. Motors are built to NEMA standards. Each unit is ready for operation when received at the installation site.

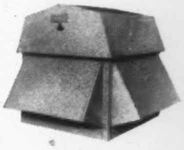
A COMPLETE LINE OF AIR MOVING EQUIPMENT











See our Catalog in Sweets

Charter Member of the Air Moving and Conditioning Association, Inc. (AMCA)

Peerless® Electric

FAN AND BLOWER DIVISION

THE Peerless Electric® COMPANY

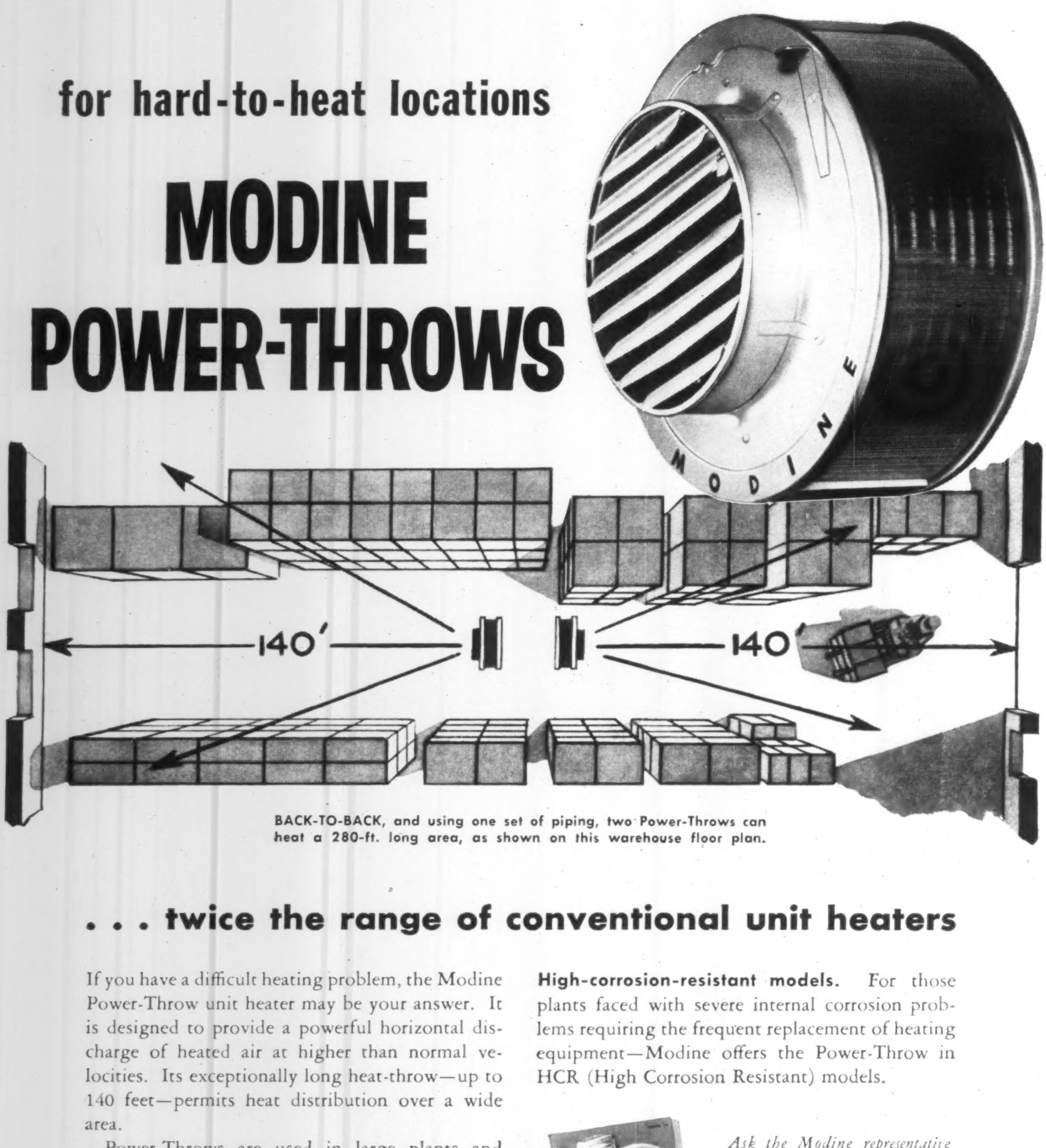
1409 W. MARKET ST. • WARREN, OHIO

FANS • BLOWERS • ELECTRIC MOTORS • ELECTRONIC EQUIPMENT

Write Today for Bulletins SDA-220, SDA-200 and SDA-160.

for hard-to-heat locations

MODINE POWER-THROWS



BACK-TO-BACK, and using one set of piping, two Power-Throws can heat a 280-ft. long area, as shown on this warehouse floor plan.

. . . twice the range of conventional unit heaters

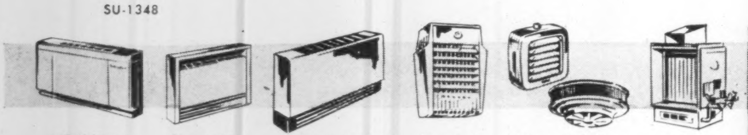
If you have a difficult heating problem, the Modine Power-Throw unit heater may be your answer. It is designed to provide a powerful horizontal discharge of heated air at higher than normal velocities. Its exceptionally long heat-throw—up to 140 feet—permits heat distribution over a wide area.

Power-Throws are used in large plants and warehouses—often to blanket frequently opened doors with a curtain of warm air. Their high capacities—271,200 to 609,600 Btu—permit them to replace a number of standard units with resulting economies in equipment and installation costs.

High-corrosion-resistant models. For those plants faced with severe internal corrosion problems requiring the frequent replacement of heating equipment—Modine offers the Power-Throw in HCR (High Corrosion Resistant) models.

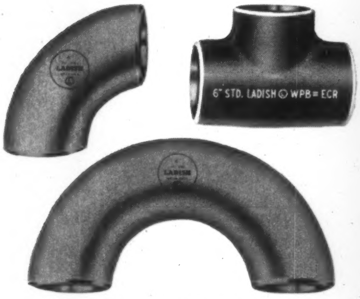
Ask the Modine representative listed in the Yellow Pages for Catalog 157 that also covers the broad range of standard Modine horizontal and vertical delivery unit heaters. Or write Modine Mfg. Co., 1509 DeKoven A. Racine, Wisconsin.

SU-1348

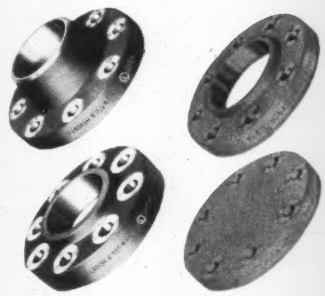


In Canada: Sarco, Ltd., Toronto

Modine
MANUFACTURING COMPANY



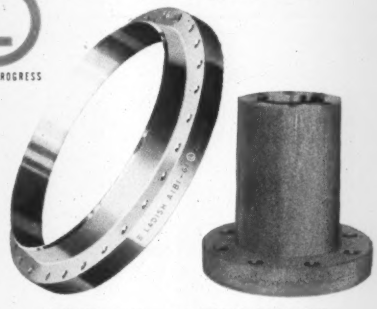
IPS—BUTT WELDING FITTINGS
½"-42" From Sch. 5S to 4" Walls



ASA and MSS FLANGES
½"-24" 150 through 2500 lbs.

TO MARK PROGRESS

TUBE O.D.—BUTT WELDING FITTINGS
½"-36" From .049" to .250" Wall



LARGE O.D. and TEMA FLANGES
Up to 20' in Diameter
LONG WELDING NECKS
1"-24" 150 through 2500 lbs.

UNIONS
⅛"-4" 150 lbs. and 2000 through 6000 lbs.

SCREWED and SOCKET FITTINGS
⅛"-4" 150 lbs. and 2000 through 6000 lbs.

LADISH

FOR *Complete Service* IN *Controlled Quality*

FORGED AND WROUGHT FITTINGS

**CARBON • ALLOY
STAINLESS STEELS
AND ALUMINUM**

WHATEVER your fittings requirements . . . regardless of the type, size, wall thickness, pressure rating or material specification . . . you can get prompt, efficient, *complete service* by specifying LADISH and ordering from your local Authorized Ladish Distributor.

A broad, full-range line produced to unsurpassed standards of metallurgical and manufacturing integrity . . . plus adequate distributor stocks . . . gives you double assurance of satisfaction.

For complete service on your fittings requirements . . . call your Authorized Ladish Distributor.

Catalogs available on request. Please indicate specific product lines for which information is desired.

THE COMPLETE *Controlled Quality* FITTINGS LINE

LADISH CO.

CUDAHY (Milwaukee Suburb) WISCONSIN

*District and *Regional Offices:* New York • *Baton Rouge • Buffalo • Pittsburgh • Philadelphia
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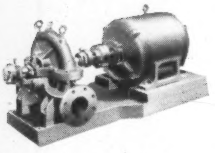
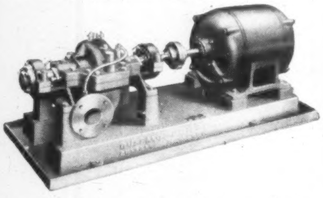
Los Angeles • *San Francisco • *Seattle • Havana • Mexico City • Brantford, Ont.

"BUFFALO" BUILDS A "CUSTOM" PUMP FOR EVERY JOB IN YOUR PLANT

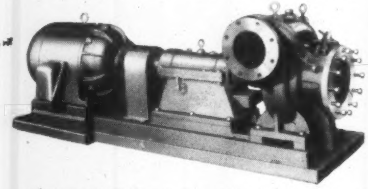
(at REGULAR pump prices!)



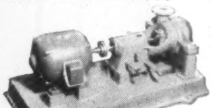
CLEAR WATER – For clear water service there is no more efficient pump than the double-suction "Buffalo" Type "SL". Its hydraulic balance, its free-flow water passages and husky construction mean economical service over many years. Capacities from 10 to 14,000 gpm. Write for Bulletin 955.



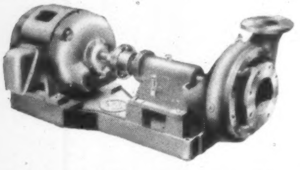
HIGH PRESSURE – "Buffalo" Type "RR" Multi-stage Pumps combine rugged strength and efficiency on boiler feed and other clear water service, against heads as high as 1500 feet, in capacities up to 900 gpm. Shafts are extra-heavy with ball bearing support on both ends — stuffing boxes are deep. Write for Bulletin 980 for all engineering details.



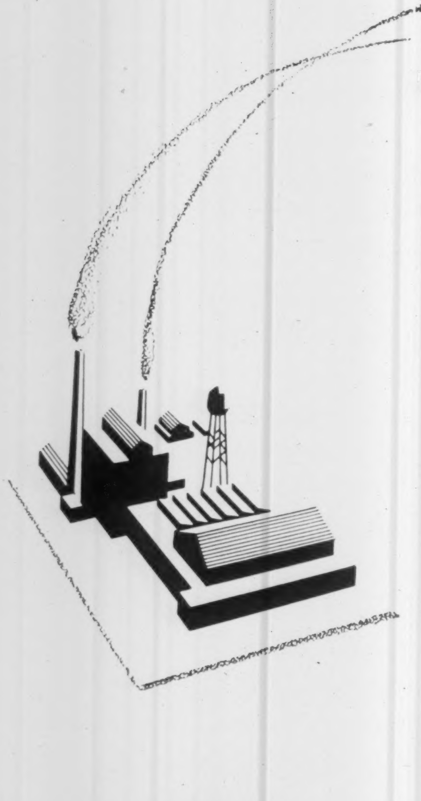
NON-CLOGGING – For moving high-consistency liquids, "Buffalo" Diagonally Split-Shell Pumps offer freedom from expensive shutdowns. And since efficiency does not depend on close impeller clearances, there is no problem of "wedging" and wear. Available rubber-lined for corrosive or abrasive liquids. Write for Bulletin 953.



HEAT TRANSFER – "Buffalo" Heat Transfer Pumps are specifically designed for high-temperature liquids. Successfully used in large installations, they employ special water-cooled bearings and packing, plus suitable alloys — built into our basic, efficient single-suction, solid shell design. Write for engineering details.



CHEMICAL LIQUIDS – "Buffalo" builds 10 special types of chemical pumps in a wide choice of trim for almost any corrosive, abrasive or high-consistency liquid. Above is a single-suction, full ball bearing model. Write for Bulletin 982 and check this wide selection.



Because "Buffalo" builds a *complete* line of pumps tailored to the liquid-moving applications of every industry, you get all the benefits of a custom-designed pump — without paying a "custom" price. You can match a "Buffalo" Pump to your exact conditions — and enjoy the high efficiency, easy maintenance and long life that only such a pump can deliver. Shown here are some of the types — simply write us about your problem, and we'll recommend the *right* pump!

ALSO . . . *"Buffalo" Close-Coupled Pumps, Sump Pumps, and Raw Sewage Pumps — all with the "Q" Factor, or built-in Quality which provides trouble-free satisfaction and long life in every "Buffalo" product.*

"Buffalo" PUMPS

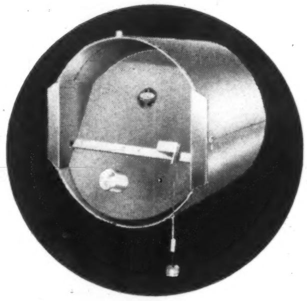
BUFFALO PUMPS

Division of Buffalo Forge Co.
171 MORTIMER STREET • BUFFALO, N. Y.
Canada Pumps, Ltd., Kitchener, Ont.
Sales Representatives in all Principal Cities

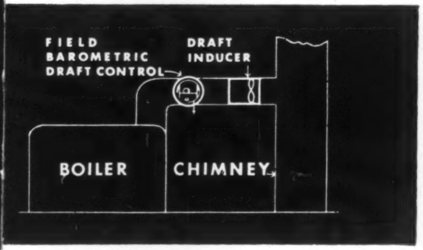
A BETTER CENTRIFUGAL PUMP FOR EVERY LIQUID

FIELD BAROMETRIC DRAFT CONTROLS

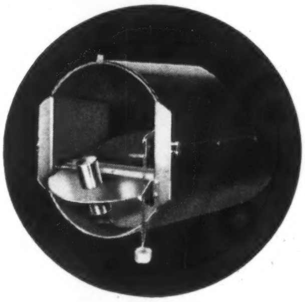
increase the efficiency of induced-draft installations



FIELD TYPE "M" Barometric Draft Control for coal or oil, sizes up to 32".



Field Barometric Draft Control installed in connection with a draft inducer prevents fuel waste caused by wide variations in draft.



FIELD TYPE "MG" Barometric Draft Control for gas or oil-gas, sizes up to 32".

When a draft inducer is used, to assist a faulty chimney, or to permit modern, low-stack construction, a Field Barometric Draft Control should also be installed. In such an installation, the inducer can be set to meet maximum, "high-fire" draft needs without risk of excessive draft. Whenever the draft requirement is less than the draft inducer setting, the Field Control automatically reduces the draft. Here is why the Field Draft Control can make an important contribution to efficiency at all firing rates:

1 - During "off-fire" periods, even the *natural* draft present may be excessive. Field reduces the draft, prevents rapid cooling of the boiler.

2 - During "low-fire" periods, the artificially induced draft may be greater than needed to vent a relatively small volume of gases. Field regulation prevents the loss of high temperature gases.

3 - During "high-fire" periods the Field Control compensates for continuously variable factors affecting draft. For example:

Changes in line voltage, affecting blower speed, change the volume of gases handled and thereby affect the draft.

Changes in resistance caused by the accumulation of fly ash or soot in boiler and breeching cause changes in the draft needed.

Changes in wind and outside temperature, affecting natural draft, cause variations in the artificial draft needed.

Where a number of boilers are discharging into a common stack, the need for draft will vary as firing rates vary. Draft required with all boilers on "high-fire" may be excessive when one or more boilers cut out.

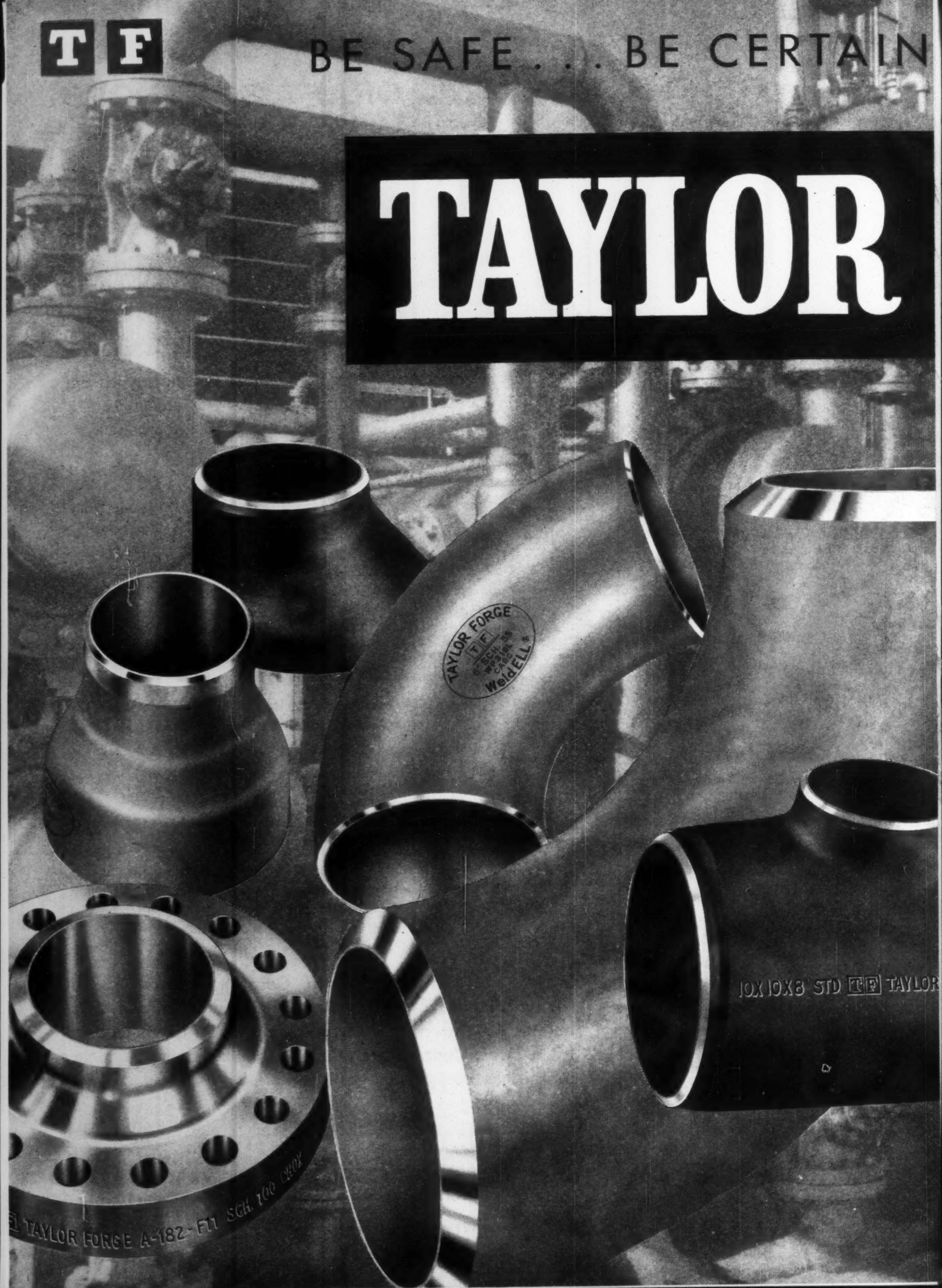
A Field Barometric Draft Control, sensitive to the slightest change in pressure, corrects for any variation, holding draft to the required setting. Write us for technical data. Field Draft Controls are available in sizes up to 32 inches for oil, gas, coal and oil-gas installations.

field

FIELD CONTROL DIVISION
of H. D. Conkey & Company, Mendota, Illinois

AFFILIATES:
Conco Building Products, Inc. • Brick, Tile, Stone — Conco Materials Handling Div. • Cranes, Hoists

Represented in Canada by Ontor Limited, 12 Leswyn Road Toronto 10, Ont., Canada


TF
BE SAFE . . . BE CERTAIN
TAYLOR
TAYLOR FORGE
TF
WeldELL
10X10X8" STD TF TAYLOR
TF TAYLOR FORGE A-182-F11 SCH. 100

. . BE CONFIDENT . . . SPECIFY—

FORGE **Welding Fittings and Forged Flanges**

Whether it's a *Carbon Steel* Tee for some ordinary service or an *Alloy Steel* Flange for a high pressure-temperature application . . . whether it's a light wall Stainless Steel WeldELL for corrosion resistance or an extremely heavy one for the most critical nuclear power plant . . . whatever it is you can be safe . . . certain . . . confident . . . if it's made by Taylor Forge. For that name and this marking T F appear only on products for piping and pressure vessel construction that are truly

TRADITIONALLY
DEPENDABLE

Taylor Forge & Pipe Works

General Offices and Works: P. O. Box 485, Chicago 90, Illinois
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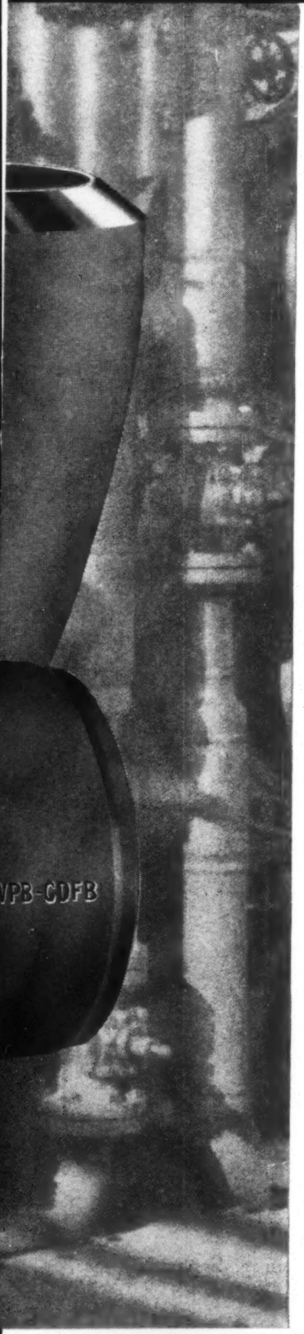
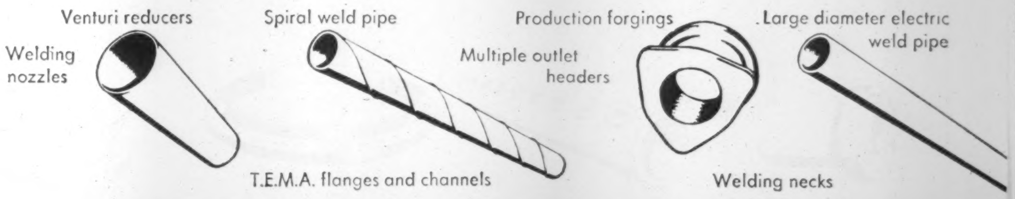
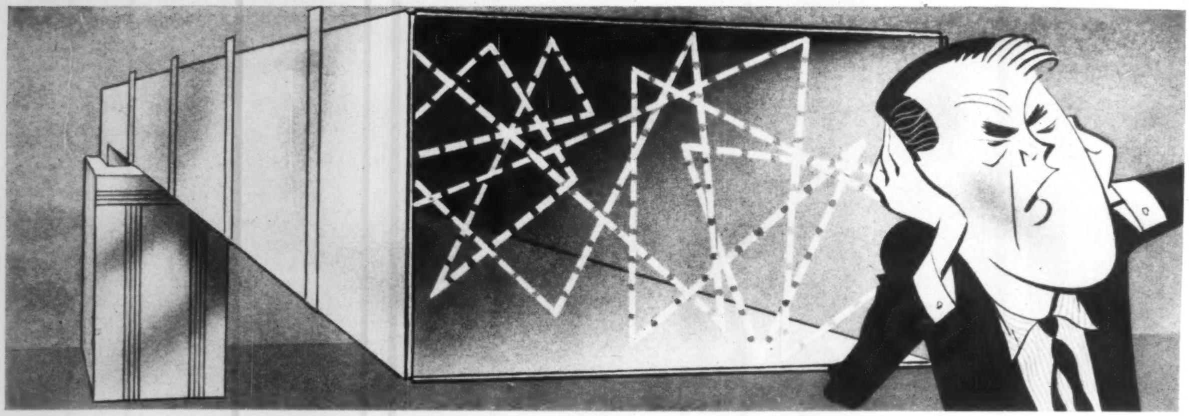
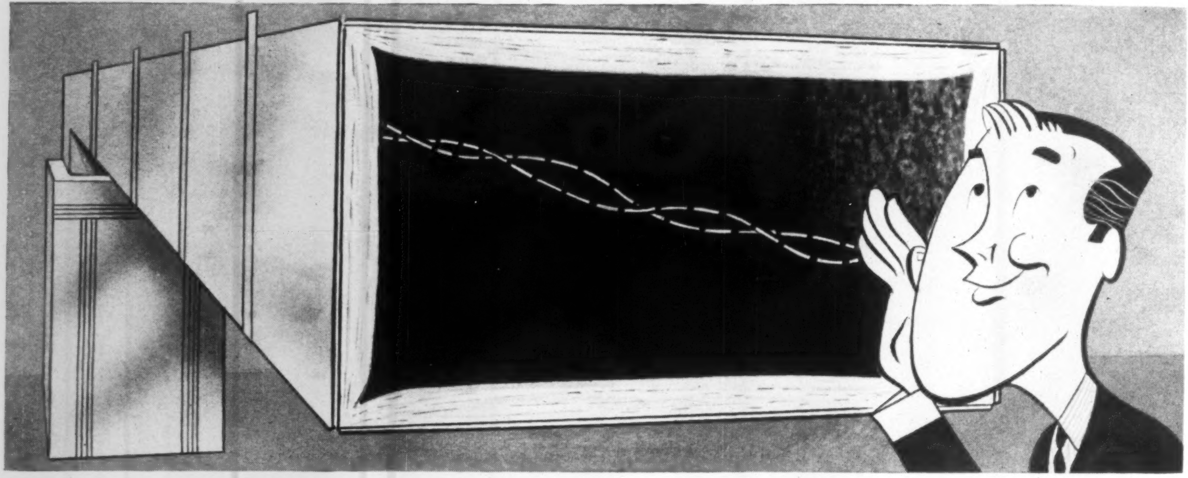
Call your Taylor Forge Distributor *For prompt, efficient service on the complete Taylor Forge line of Welding Fittings and Forged Flanges, patronize your local Taylor Forge Distributor.*




Venturi reducers
Welding nozzles
Spiral weld pipe
T.E.M.A. flanges and channels
Production forgings
Multiple outlet headers
Large diameter electric weld pipe
Welding necks



Mute air-conditioning-duct noises...



with black-vinyl-coated MICROTEX

New duct liner has high acoustical and thermal efficiency... plus the moneysaving advantages of pigmented vinyl coating

Microtex Duct Liner effectively absorbs mechanical noises—particularly in the 250 to 4,000 cps range, where most air-conditioning and heating-system noises occur. It efficiently insulates warm- and cold-air ducts against heat transfer. When ducts are lined with Microtex, the sheet metal itself acts as a vapor barrier.

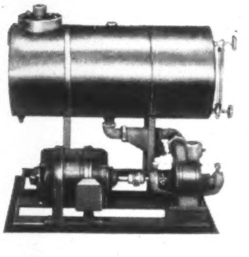
L·O·F Glass Fibers' Microtex Duct Liner saves time and money at the job site. Its black vinyl coating saves painting inside ducts, near grilles or large registers; eliminates the possibility of paint flaking off into the air stream. Pigmented vinyl quickly shows inspectors that Microtex Duct Liner is *fully coated* to resist air erosion, even at peak velocities. When ducts are lined, exterior surfaces are easy and economical to paint or finish as desired.

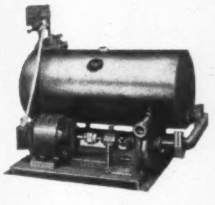
Microtex Duct Liner cuts costs in the shop, too. It's strong and resilient . . . easily withstands routine shop handling without damage. Microtex is semirigid, yet light in weight . . . easy to cut, pleasant to handle. Black vinyl clearly indicates the air-stream side as Microtex is applied to the sheet metal. Resiliency of Microtex permits forming insulated metal sheet in the brake without damage.

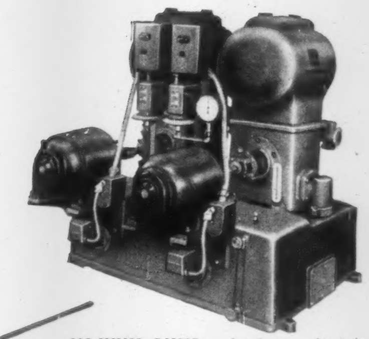
Get the facts today on economical Microtex Duct Liner in 1½, 2 and 3 lb./cu. ft. densities. Contact your distributor, or write: *L·O·F Glass Fibers Company, Dept. 39-97, 1810 Madison Avenue, Toledo 1, Ohio.*

LOF GLASS FIBERS

L·O·F GLASS FIBERS COMPANY · TOLEDO 1, OHIO

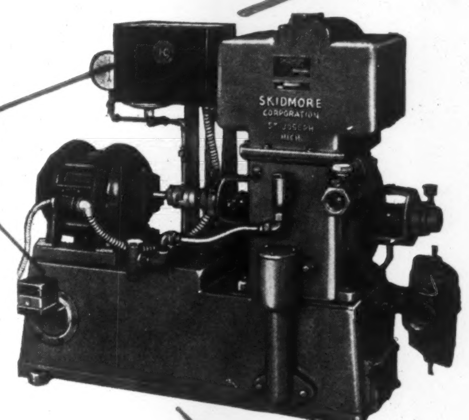

TYPE "TM" TURBINE PUMP


TYPE "HS" CONDENSATE PUMP

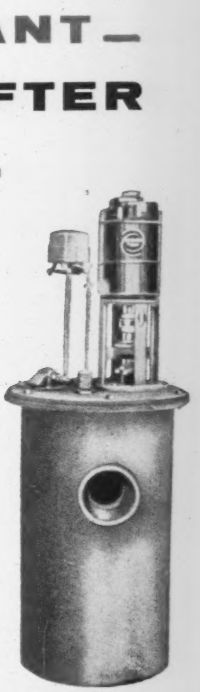

VACUUM PUMP—duplex unit

EFFICIENCY REMAINS CONSTANT— YEAR AFTER YEAR...

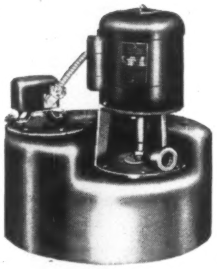
MAINTAINED
SKIDMORE PUMPS
EFFICIENCY



VACUUM PUMP—single unit. The SKIDMORE Vacuum Pump automatically adjusts itself to the varying conditions of the system. Capacity remains constant without adjustments or extensive repairs.


SKIDMORE TYPE "TM" CONDENSATE PUMP

Send Coupon For Bulletins


TYPE "CVS" VERTICAL PUMP

There's a Skidmore Pump built for every heating requirement.

SKIDMORE CORPORATION

ST. JOSEPH, MICH.

SKIDMORE CORPORATION, ST. JOSEPH 5, MICHIGAN

Please send bulletins on the following pumps checked below.

CVS TM HS UV VACUUM

Name ....

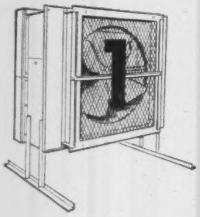
Firm ....

Address ....

City .... State ....

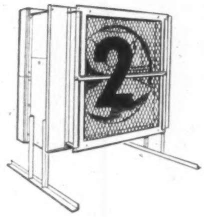
ONLY KRAMER UNICON + WINTERSTAT* GUARANTEES ALL 4

MAXIMUM LIQUID PRESSURE AT EXPANSION VALVE IN WINTERTIME



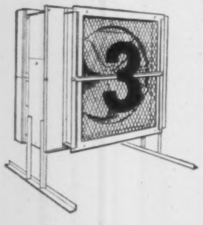
Only the Kramer UNICON plus WINTERSTAT guarantees the full refrigerant pressure *at the expansion valve* for full cooling capacity — even at below 0°F outdoors — *automatically!*

MAXIMUM SUMMER CAPACITY WITH PATENTED WINTERSTAT



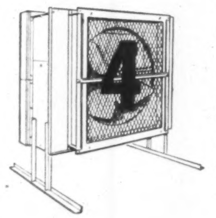
Only Kramer UNICON plus WINTERSTAT guarantees maximum condensing capacity in summer. In hot weather, the patented WINTERSTAT is out of the refrigerant circuit, permitting normal drainage from the condenser without restriction. This assures maximum condensing capacity in summer — *automatically!*

PROMPT DEFROSTING AT ANY OUTDOOR TEMPERATURE



The use of UNICON plus WINTERSTAT makes Kramer THERMOBANK the only low temperature system that can guarantee operation and complete defrosting at any outdoor temperature—even 0°F or lower—*automatically!*

IMMEDIATE COMPRESSOR START-UP REGARDLESS OF OUTDOOR WINTER TEMPERATURE



Only Kramer UNICON plus WINTERSTAT (using modification #1) ensures positive and immediate compressor start-up with pressurestat operating the system, regardless of outdoor winter temperatures at the UNICON and regardless of length of compressor lay-off — *automatically!*

**UNICON is a remote type air-cooled condenser WINTERSTAT is a year 'round automatic head pressure control*

WRITE FOR BULLETIN U-210-L

KRAMER TRENTON CO. • Trenton 5, N.J.

44 YEARS OF CONTINUOUS ACHIEVEMENT IN HEAT TRANSFER

SINCE 1901 . . .
THERMOTANK®
Originators of . . .
HIGH VELOCITY THERMO-REG UNITS
PUNKAH®-LOUVRES AND OTHER DEVICES
SINCE 1939 . . . .
AGITAIR®
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SQUARE, RECTANGULAR AND CONTINUOUS DIFFUSERS
ALL TYPES ROUND DIFFUSERS • FILTERS • EXHAUSTERS

LINKED TOGETHER

- *For your convenience in solving ALL air handling requirements*

Sold Exclusively by Representatives for

AIR DEVICES INC.

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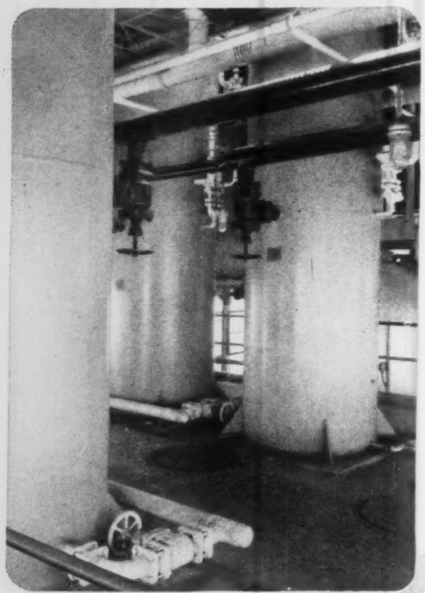
TRADE FRICK MARK®

THE ARMOUR LABORATORIES

Refrigeration Serves Big Armour Laboratories



Armour and Co. use "cold" in many ways in their great Pharmaceutical Laboratories, recently opened near Kankakee, Ill. These uses include air conditioning, biological process work, cold storage, heat-pump service, and research.

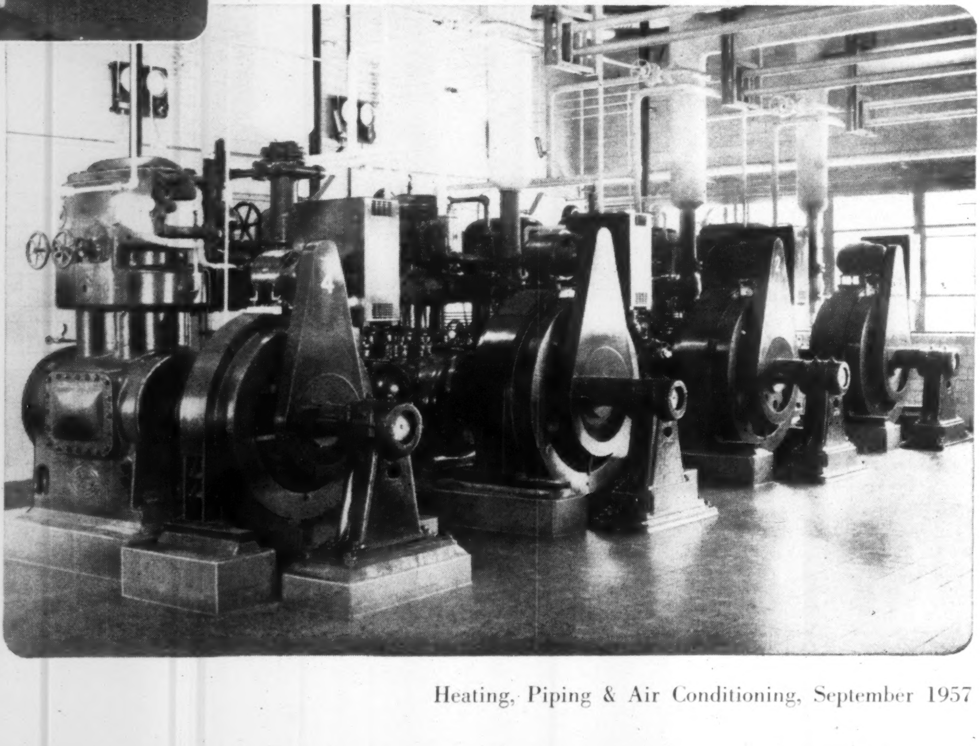
Temperatures can be held anywhere between —45 and +45 degrees F., but usually go no lower than —10.

Here a 2-stage Frick system of 1422 tons refrigerating capacity operates with efficiency and economy. Installation by Midwest Engineering and Equipment Co., Frick Sales-Representatives in Chicago.

For that important refrigerating, air conditioning, ice making or quick freezing job of yours, look to dependable Frick equipment. Sales-engineering and service, the world over. Let us submit estimates now: write, wire or phone

DEPENDABLE REFRIGERATION SINCE 1882
FRICK CO.
WAYNESBORO, PENNA., U. S. A.

Above: Three of four Shell-and-tube condensers at the Laboratories.

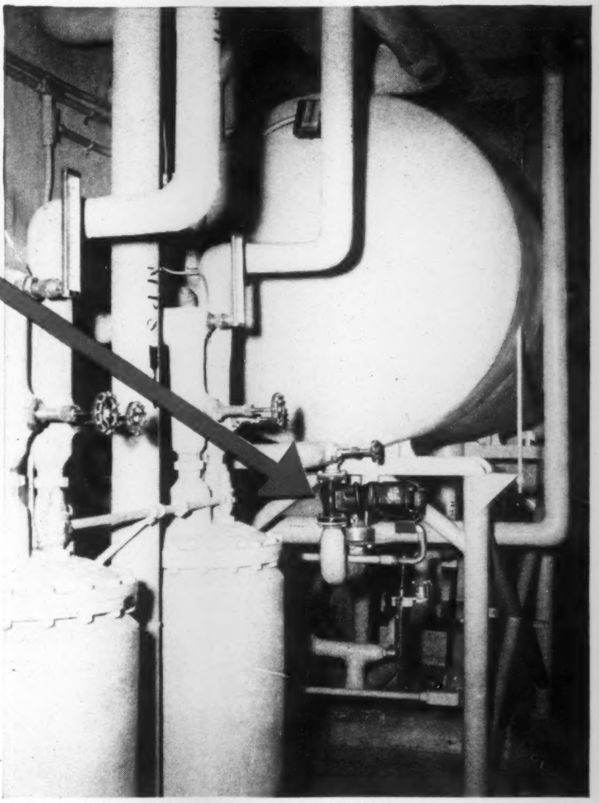


Right: Four of eleven ammonia compressors furnishing refrigeration at temperatures down to —45° F. for The Armour Laboratories, Kankakee, Ill.

B&G ALL-BRONZE BOOSTERS

FOR LONG LIFE IN CIRCULATING HOT OR COLD RAW SERVICE WATER FOR FAUCET OR INDUSTRIAL USES

NOW
PAINTED BRONZE
...FOR EASY
IDENTIFICATION

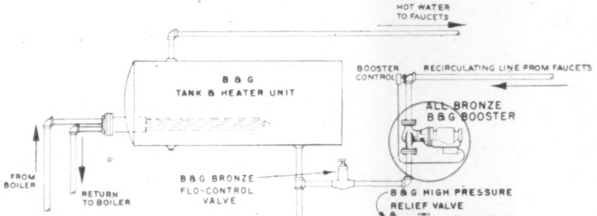


Installation of B&G All-Bronze Booster in Chrysler automatic transmission plant at Kokomo, Indiana. This small unit handles the circulating requirements of the service water heating system.

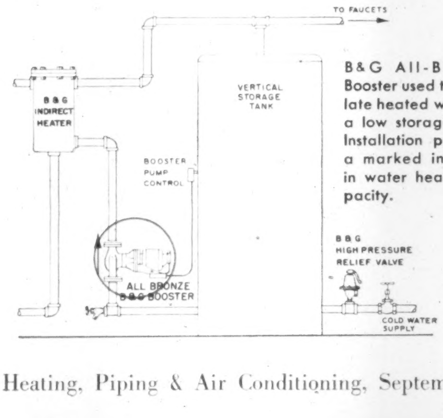
Where hot or cold service water is to be pumped, the use of an all-bronze pump is imperative. Otherwise, the corrosive effects of continuously pumping fresh water materially shortens pump life.

The B&G All-Bronze Booster is specifically built for service water pumping applications. In such systems, the Booster can be installed in numerous ways to step-up efficiency, increase hot water production and reduce heating costs. It is immune to corrosion, hence will give years of dependable service.

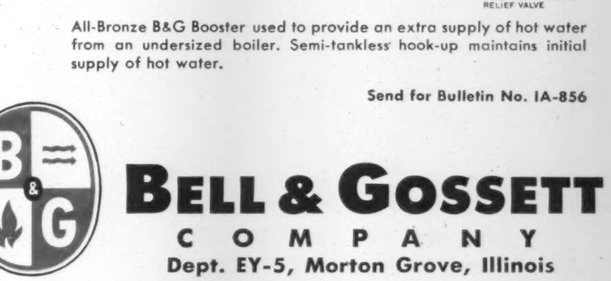
For *quiet* operation, failure-proof performance and long life, the B&G Booster is the *preferred* pump.


HOT WATER TO FAUCETS
B & G TANK & HEATER UNIT
BOOSTER CONTROL
RECIRCULATING LINE FROM FAUCETS
ALL BRONZE B&G BOOSTER
FROM BOILER
RETURN TO BOILER
B&G BRONZE FLO-CONTROL VALVE
B&G HIGH PRESSURE RELIEF VALVE
COLD WATER SUPPLY

B&G All-Bronze Booster used on recirculating line from hot water faucets maintains hot water at fixtures at all times. Recommended on all installations, particularly where long plumbing lines are used.


TO FAUCETS
B&G INDIRECT HEATER
VERTICAL STORAGE TANK
BOOSTER PUMP CONTROL
ALL BRONZE B&G BOOSTER
B&G HIGH PRESSURE RELIEF VALVE
COLD WATER SUPPLY

B&G All-Bronze Booster used to circulate heated water to a low storage tank. Installation provides a marked increase in water heater capacity.


TO FAUCETS
MANUAL VENT
BOOSTER CONTROL
RECIRCULATING RETURN LINE
ALL BRONZE B&G BOOSTER
HOT WATER STORAGE TANK
B&G BRONZE FLO-CONTROL VALVE
COLD WATER FILL
B&G HIGH PRESSURE RELIEF VALVE
B&G INSTANTANEOUS HEATER

All-Bronze B&G Booster used to provide an extra supply of hot water from an undersized boiler. Semi-tankless hook-up maintains initial supply of hot water.

Send for Bulletin No. IA-856

BELL & GOSSETT
COMPANY
Dept. EY-5, Morton Grove, Illinois

Canadian Licensee: S. A. Armstrong Ltd., 1400 O'Connor Drive, Toronto 16, Ontario

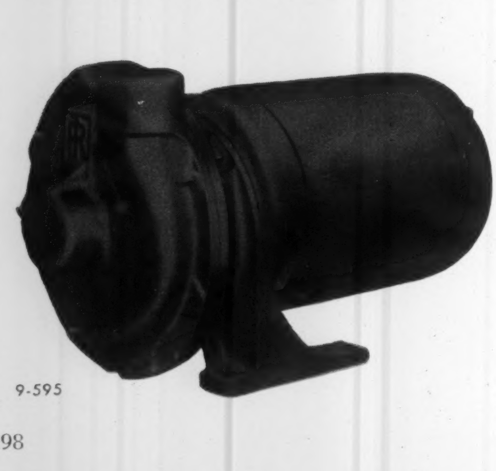
THE MOTORPUMP
IS ALWAYS A GOOD

sales point

Customers buying air conditioning systems are vitally interested in the various components that make up the system. They want brand names they know and recognize . . .

When you offer Ingersoll-Rand Motorpumps as an integral part of the systems you sell, your customers are getting dependable, trouble-free service from compact pumps designed specifically for air conditioning service. *You* get easy installation, fewer service calls . . . and more satisfied customers.

Motorpumps are available from ¼ to 75 horsepower. Write for our latest literature on Motorpumps for air conditioning service.



Ingersoll-Rand
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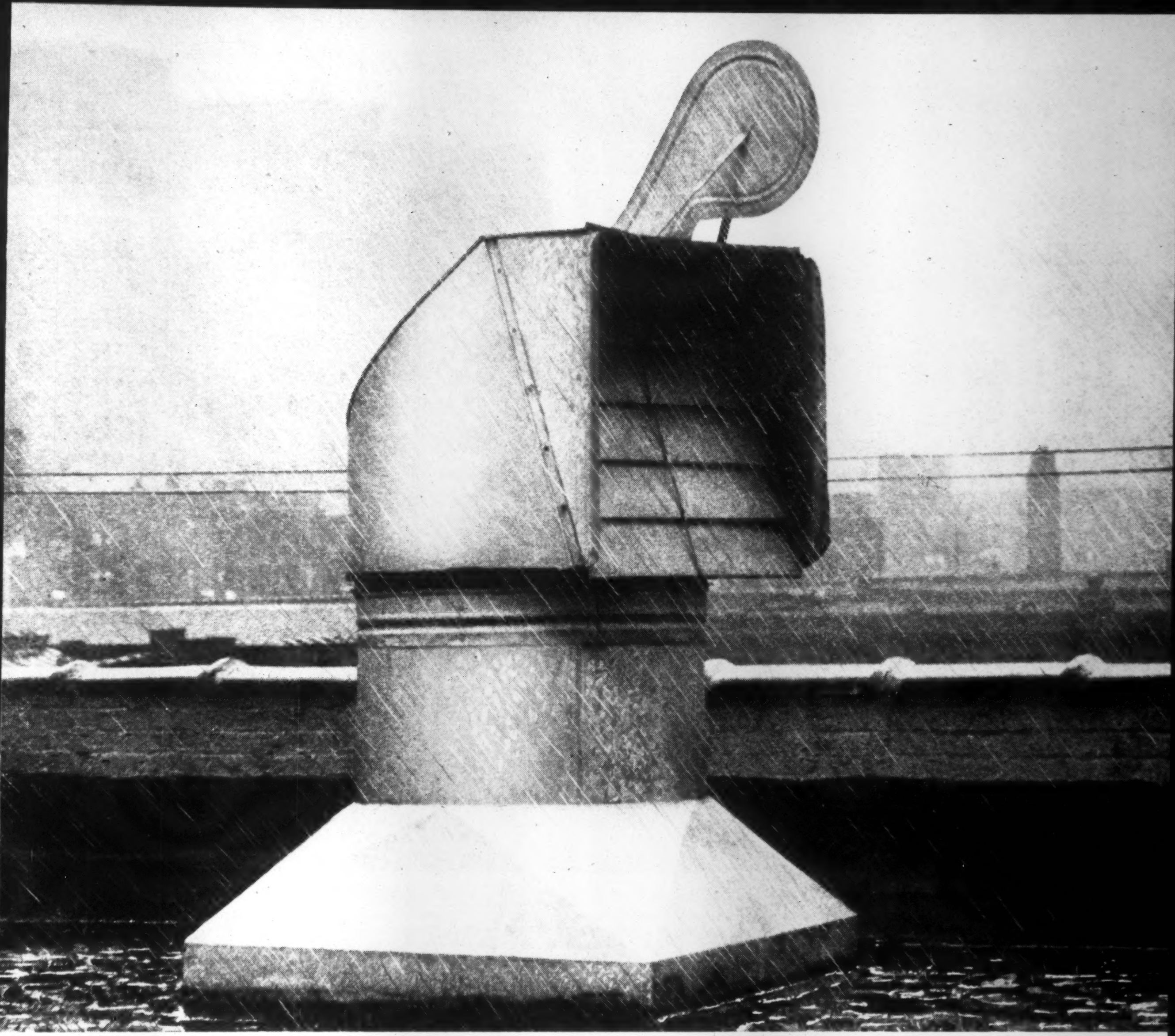
9-595



WEIRKOTE'S® skin-tight zinc coating never gives rust a break

No wonder the steady shift is to Weirkote zinc-coated steel! No wonder more and more spec sheets insist on Weirkote—like this:

> *SHEET METAL WORK—Materials—Galvanized steel. Unless otherwise specified, this shall be of 26-gauge galvanized sheet steel, of "Weirkote" with make and gauge stamped on each sheet.*

Weirkote's continuous-process zinc coating is uniformly skin tight, flawless. It's made that way to *stay* that way through the toughest fabrication and roughest job-site handling. No flaking, no peeling.

It brings first-class corrosion resistance and long life to roof ventilators, heating and ventilating ductwork, ducts for dust and fume removal, rain drainage systems, water type air coolers, other sheet metal uses. Low first cost, low maintenance cost.

Free Weirkote Booklet

Send for the new Weirkote booklet today. Write Weirton Steel Company, Dept. M-17, Weirton, West Virginia.

WEIRTON STEEL COMPANY

WEIRTON STEEL COMPANY

WEIRTON, WEST VIRGINIA
a division of
NATIONAL STEEL CORPORATION

"from Chicago"

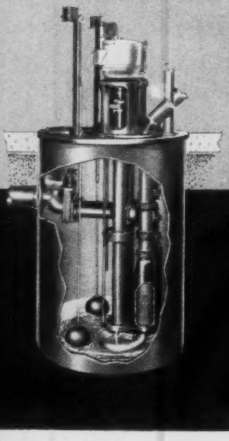
THE 'INSIDE' STORY IS IMPORTANT TOO!

SOCONY MOBIL BUILDING
NEW YORK, NEW YORK

ARCHITECTS: Harrison-Abramovitz and John B. Peterkin • GENERAL CONTRACTOR: Turner Construction Company, New York, New York • PLUMBING CONTRACTOR: Eugene Duklauer, Inc., 215 E. 38 Street, New York, New York • MECHANICAL ENGINEERS: Jaros, Baum and Bolles, 415 Lexington Avenue, New York, New York • PHOTO: Wurts Brothers, 15 East 40th Street, New York, New York

"FLUSH KLEEN"® Sewage Ejector

. . . Automatically Backwashes Strainer . . . Strainer Keeps Solids From Basin And Pump . . . Water Only Handled By Impeller



The whole story of a modern skyscraper is not limited to striking architecture and gleaming exterior. Of equal importance is the equipment within the building that provides for comfort of the occupants and efficiency of the building operation.

In fine buildings everywhere, like New York's Socony Mobil Building, the Chicago Pump Company "FLUSH KLEEN"® Sewage Ejector is standard equipment because it is the only true clog proof ejector. More than 12,000 have been installed and not one has clogged.

In the "FLUSH KLEEN"® Sewage Ejector only liquid reaches the pump impeller. There is no contact between the ejector's working parts and coarse sewage material.

This is why the Chicago Pump Company "FLUSH KLEEN"® Sewage Ejector has an unequalled record of clog proof performance and is preferred throughout the building industry.

CHICAGO PUMP COMPANY

Building Pumps

Subsidiary of Food Machinery & Chemical Corporation

fmc

622 Diversey Parkway
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Get this booklet that's getting rave notices

McDONNELL

Basic Safety Controls for Hot Water Space Heating Boilers

Doing One M&M *Thing Well*

McDONNELL & MILLER, Inc., 3500 N. Spaulding Avenue, Chicago 18, Illinois

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THIS ILLUSTRATED BOOKLET is causing a lot of talk in the industry as the first authoritative discussion of a most important subject. Essentially it is an engineering booklet rather than a product catalog. In simple, easy-to-follow style it tells why safety devices are needed on hot water space heating boilers, which ones to use, and how to select them. Information every heating man should have.

THE COMMENTS YOU SEE HERE came from men in the heating industry after they read this booklet. We mailed out some copies as it came off the press. This is only a small sample of the enthusiastic responses we received.

THE COUPON YOU SEE BELOW is for you, to get your copy of this new booklet. Many local codes and federal specifications now call for the safety devices it recommends. If you haven't had a copy yet send back the coupon right now.

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Boiler Water Level Controls

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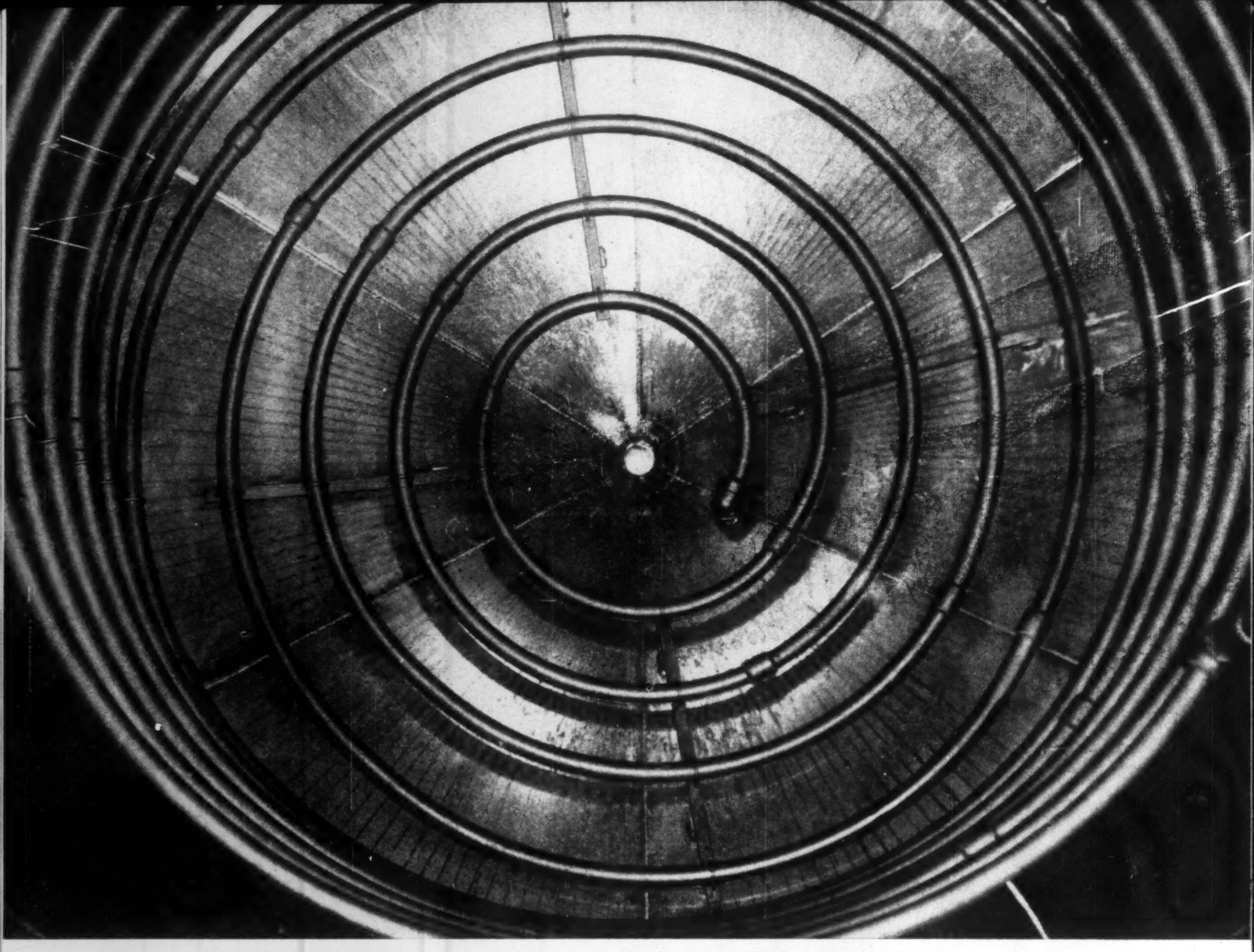


This processing tank employs wrought iron pipe for heating coils. Excellent bending properties, as well as corrosion resistance, lead to wrought iron's selection for this installation.

Wrought Iron Pipe's ductility permits speedy bending and stretching without rupturing the metal

Readily bent and formed, hot or cold, wrought iron pipe's high-purity base and fibrous structure assure little or no "springback."

Evidence of wrought iron pipe's excellent bending properties is the extensive use of the material for heating coils, refrigeration coils and air brake piping where short radius bends are necessary. You can tack on the corrosion and fatigue resisting properties of the material, too, for its acceptance in these applications. Our technical bulletin, *The Bending and Flanging of Wrought Iron Pipe,* shows how to produce uniformly superior results. Write for a copy. A. M. Byers Company, Clark Building, Pittsburgh 22, Pennsylvania.

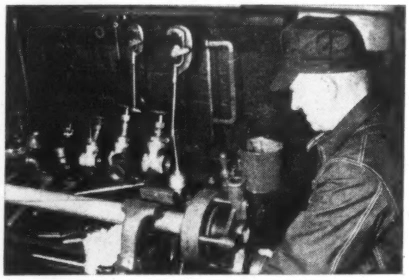
Available in Canada and throughout the world

◀ EASY TO WELD

Wrought iron produces sound welds by any of the commonly used processes because it is self-fluxing. Complete line of wrought iron welding fittings for pipe is available in sizes ¼" to 12".

EASY TO THREAD ▶

The machining and threading properties of wrought iron pipe are excellent. The uniform structure of the metal contributes to smooth, sharp threads.



BYERS Wrought Iron Tubular and Hot Rolled Products

ALSO ELECTRIC FURNACE QUALITY STEEL PRODUCTS

SNAP*ON makes a measurable difference in heat loss...and initial cost...

... because this one-piece pipe insulation molded of fine glass fibers has no equal in thermal efficiency for cold and heated piping and no equal for low applied costs.

With Snap*On you can actually measure the difference in . . .

1. **Lower operating costs** due to greater insulating efficiency.
2. **Lower material cost** because less wall thickness is required to do an equal or better thermal insulation job than other pipe insulations.
3. **Labor savings** in installation range from 10 to 50% compared to other insulations.

One-piece sections of Snap*On are also light weight, won't break and they snap on the pipe with one easy step. Available in single cylinders with one seam for all pipe sizes to 33", plain, for field application of jacket, or with factory applied canvas, vapor barrier or weatherproofing jackets.

Let one of our sales engineers make a *Thermo-Economic Value Analysis* of your next job to show how Snap*On will make a "measurable" difference in initial investment and operating costs. Write today.

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GUSTIN-BACON

Manufacturing Company GUSTIN gb BACON

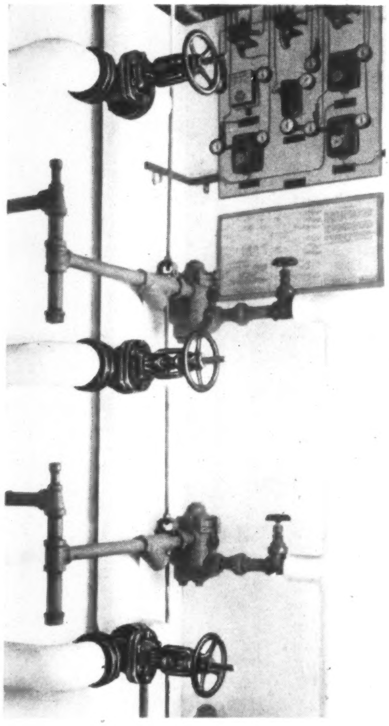
Thermal and acoustical insulations • Molded glass fiber pipe insulation

Pipe couplings and fittings

220 W. 10th St., Kansas City, Mo.

Rx for the new home of **Ethicon...**

where dependable control of processes is essential – JENKINS VALVES



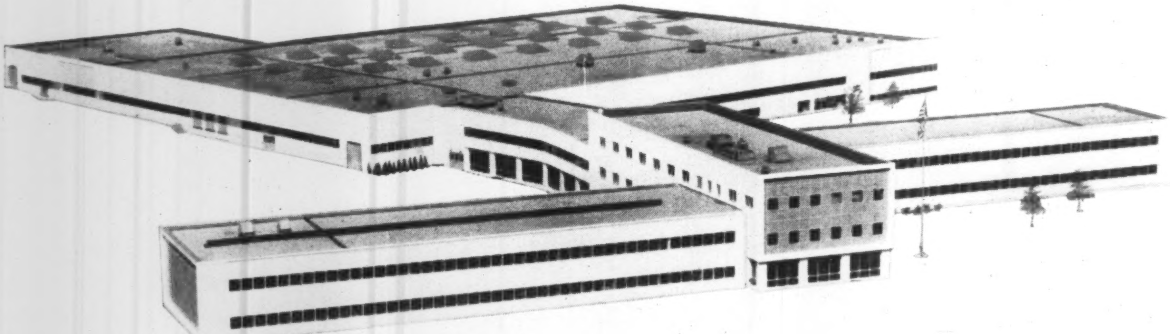
Jenkins Fig. 651-A iron body gate valves and Fig. 370 bronze gate valves on the air conditioning system.

In modern architectural plant design as in product development and improvement, ETHICON, INC., a subsidiary of Johnson & Johnson, is "Setting New Standards". Its new home office and main finishing plant in Somerville, N. J. embodies the most modern equipment and facilities for the manufacture of surgical sutures and allied products for the medical profession.

Manufacture of such products obviously demands absolute control over processing. To meet these critical requirements, equipment had to be selected with extreme care. For dependable control of pipelines which supply essential steam, water, air-conditioning, and other services, Jenkins Valves were prescribed.

This confidence in the extra measure of efficiency and reliability of Jenkins Valves has shown up in the specifications of important plants and buildings for nearly a century. It is symbolized by the Jenkins Diamond and Signature trade-mark. The valves that bear this famous mark cost no more.

Jenkins Bros., 100 Park Ave., New York 17.



Architects: SERGE P. PETROFF & ASSOCIATES
Mechanical Engineer: MUZZILLO & TIZIAN
Construction Engineer: NORMAN W. KEMPSON
Mechanical Contractor: RICHARDSON ENGINEERING COMPANY
General Contractor: JOHN W. RYAN CONSTRUCTION CO., INC.

JENKINS VALVES

LOOK FOR THE JENKINS DIAMOND

JENKINS SINCE 1864

Jenkins Bros

Sold Through Leading Distributors Everywhere

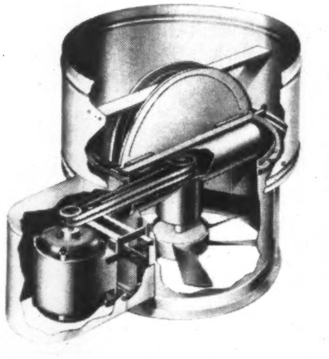
EQUIPMENT DEVELOPMENTS . . .

For reviews of Recent Trade Literature see Page 252

Molybdenum Tubing . . .

. . . for nuclear power plants—*Wolverine Tube, Div. of Calumet & Hecla, Inc., Dept. HPAC,* 1141 *Central Ave., Detroit.*

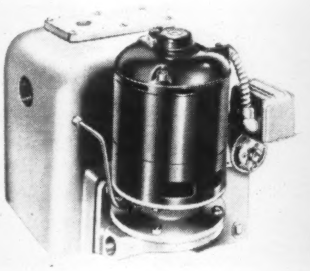
Molybdenum is said to be strongest known metallic material at temperatures exceeding 1700 °F, also corrosion resistant to liquid metals. Dimensions of extruded tubing are: less than 1 in. OD; about 0.1 in. wall thickness; 3 to 6 ft in length. Tensile strength is 70,000 to 100,000 psi and yield strength is 60,000 to 90,000 psi.



Power Roof Ventilator . . .

. . . with airfoil type fan mounted in weatherproof fan casing—*L. J. Wing Mfg. Co., Div. of Aero Supply Mfg. Co., Inc., Dept. HPAC, Linden, N.J.*

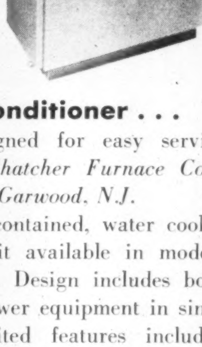
Dampers opened immediately by airstream, held open as long as fan is operating, says company. In two types: "Type B," for exhausting hot, corrosive or fume laden air, has motor located out of airstream, in weatherproof housing, driving fan by means of v-belt; "Type C," for exhausting uncontaminated air, has motor located in airstream direct connected to fan wheel.



Condensation Pumps . . .

. . . for small steam boilers—*Sterling, Inc., Dept. HPAC,* 3738 *N. Holton St., Milwaukee* 12.

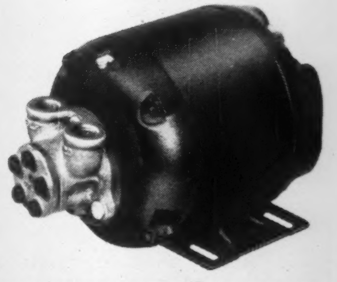
"No. 4223-E" designed to serve boilers of 3000 sq ft and smaller at discharge pressures to 20 psi. Flexible adjustment is said to eliminate alternate flooding, starving of small boilers. Built with 1/4 hp, 1/60/115-230 volt motor, available in 3/60/220-440.



Air Conditioner . . .

. . . designed for easy servicing in field—*Thatcher Furnace Co., Dept. HPAC, Garwood, N.J.*

Self contained, water cooled summer unit available in models 5 to 15 tons. Design includes both cooling, blower equipment in single cabinet. Cited features include extra heavy sheet glass fiber insulation panels, "unique" combination of horizontal and vertical louvers. Manufacturer also announces summer unit which can be added to existing warm air systems where water is scarce or expensive, and water cooled model which can be installed either with ductwork or as free standing package unit. Both these lines in 2, 3, 5 ton capacities.



Pump-Motor Units . . .

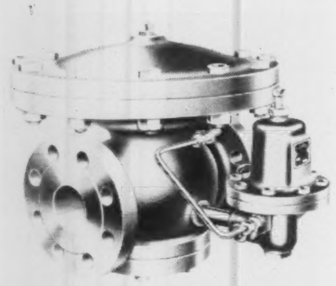
. . . for singular plant applications which do not warrant custom design—*Tuthill Pump Co., Dept. HPAC,* 939 *E. 95th St., Chicago* 19.

Can be used in varying combinations for hydraulic, oil burning, lubricating, other services involving different fluids, says company. Close-coupled design is said to provide savings in space, weight, expense, assembly time.

Flux-Cored Alloy . . .

. . . for stainless steel, other base metals—*Eutectic Welding Alloys Corp., Dept. HPAC,* 40-40 172*nd St., Flushing* 58, *N.Y.*

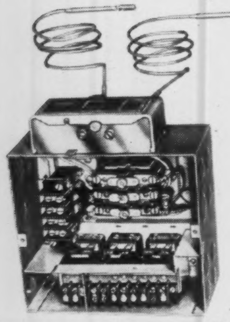
"EutecRod 157B" silver bearing, lead free, solder type alloy in coil form has following features, says company: May be used for all types of joints in stainless steel fabrication and for dissimilar metal joining, especially to copper, brass, bronze; for low application temperature range 400 to 500 F; have higher strength (ultimate tensile strength to 15,000 psi); leave lead free deposits that do not blacken. Available in 1/8, 1/16, 3/64 in. diameters.



Reducing Valves . . .

. . .for steam service—*Fisher Governor Co., Dept. HPAC, Marshalltown, Iowa.*

"92B" is self operating unit, obtaining pilot operating medium directly from inlet, says company. Engineered for applications where air or gas as medium is not available or where use is not practical. Design is said to minimize problems such as clogged orifices, sticky valves, diaphragm rupture.



Master Control Panels . . .

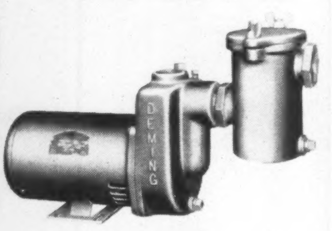
. . .added to company's line of cooling controls—*White-Rodgers Co., Dept. HPAC,* 1209 *Cass Ave., St. Louis* 6.

Available in single, two-piece types. Single panel, for use on packaged cooling units and those with water cooled condensing units, incorporates both evaporating sequencing and condenser sections in one enclosure. Two-piece panel designed primarily for systems having remote air cooled condensing units.

Strapping System . . .

. . .designed for applying insulation to ducts, other equipment—*Taft-Jenkins Co., Inc., Dept. HPAC, Holyoke, Mass.*

"Pin-Tite" strapping applied directly to equipment to be insulated. Insulation is then impaled on factory inserted spears. Spears have lock ridges to lock speed washer to hold insulation to strapping. Strapping is beneath insulation, not over it. In two sizes: one, for use with 1 in. thick flexible type wraparound insulation, has 1 in. spears set on 6 in. centers; other, for rigid type insulations, has 2 in. spears on 9 in. centers.



Centrifugal Pumps . . .

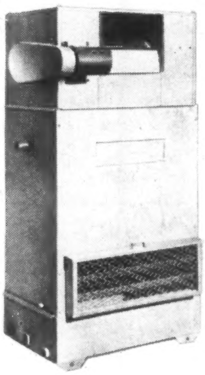
. . . in new self priming line of "Motor-Mount" units—*Deming Co., Dept. HPAC, Salem, Ohio.*

Units designed for general liquid handling. Line includes "Fig. 3351," ranging 1/3 to 1½ hp, and "Fig. 3350," available in 2, 3, 5 hp. Construction features include bronze impeller, stainless steel shaft, mechanical seal, built-in motor overload protection on 2 hp and smaller motors.

Cooling Towers . . .

. . .designed for very quiet operation—*Dover Mfg. Co., Dept. HPAC,* 3117 *Weatherford Ave., Independence, Mo.*

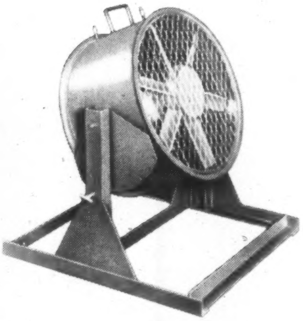
"Series V" towers use centrifugal blower instead of fan. Feature is said to eliminate noise problems, allow unit to be placed near workers without disturbance. Available in sizes 5 to 100 tons. Recommended by company for installation where space is factor, either inside or outside of building. Air intake, outlet on same side of unit (in sizes below 50 tons) permitting installation flush to wall.



Pyrometer . . .

. . .for both surface and air temperatures—*Illinois Testing Laboratories, Inc., Dept. HPAC,* 420 *N. LaSalle St., Chicago* 10.

"Type 2300 B" unit includes two thermocouples. One designed for surface temperatures, another for air temperatures. Both thermocouples with their lead wire assemblies fit into portable unit when not in use. Cited applications include balancing hot water heating systems and checking heating panel temperatures, diffuser or grille outlet air temperatures, zone or area air temperatures.



Adjustable Cradle Fan . . .

. . .for commercial cooling, drying—*Chicago Blower Corp., Dept. HPAC,* 9863 *Pacific Ave., Franklin Park, Ill.*

Belt driven "AC" provides air cir-

you don't have to
have a white roof
To Protect Against the Summer Sun

The summer sun pours down as much as 250,000 Btu's of heat per hour on a 1,000 sq. ft. roof of a house at noon on a clear day. Some white shingles can reflect, OUTDOORS, about 55% of the sun's rays; yellow shingles 35%, green 15%, red 14%, blue 5%, black 4%.

White shingles won't always stay white, don't always harmonize with the color-scheme, easily look soiled. So despite the greater efficiency of white (which is true only OUTDOORS), roofs may nevertheless be ANY color; and the house will still be considerably cooler than the outside; IF MULTIPLE REFLECTIVE spaces and reflective surfaces are installed beneath the roof.

The comfort and efficiency of this scientific combination, produced by multiple sheets of aluminum and fiber, air-spaced apart, is remarkable for its effectiveness in repelling radiation, which is responsible for about 93% of all *heat in-flow* down from the roof to living quarters. The surfaces of the aluminum reflect radiation with a 97% rate, and absorb and emit radiation at a rate of only 3%.

Since there is NO convection in down heat flow, and slight conduction through low density air spaces, a triple barrier to *heat in-flow* is raised. Summer coolness and comfort are enhanced, night and day, often 15° F cooler than the shade outdoors, for the slight cost of the *insulation alone.*

ALSO RETARDS WINTER HEAT LOSS

In winter too, this form of insulation is effective, because 55% to 70% of heat flow upwards through air space is by radiation. Convection, ranging to 45%, is retarded by the multiple aluminum sheets. In up heat flow, conduction is also slight because of air's low density.

The best shingles or most beautiful paint job on the exterior or interior, will not protect against peeling paint, timber rot, and crumbling plaster caused by destructive condensation.... The multiple aluminum, almost impervious to water vapor, minimizes condensation formation on or within it by its scientific construction.

How solar rays which strike the outside of a building become heat rays which oppress those inside; why white paint, and other white surfaces in *enclosed* places perform no better than black in reflecting heat, are interestingly discussed in Schwartz's 48-page informative, authoritative, readable manual: "Heat Flow by Radiation in Buildings." You'll really enjoy reading it; use the coupon.

THERMAL VALUES
Infra Type 4 Parallel Insulation

Down-Heat C .042*=7⅞" non-metallic insulation†
Up-Heat C .105*=3⅛" non-metallic insulation†
Wall-Heat C .068*=4¾" non-metallic insulation†

Cost installed between wood joists, material and labor, about 8¢ sq. ft.

Type 6 also available

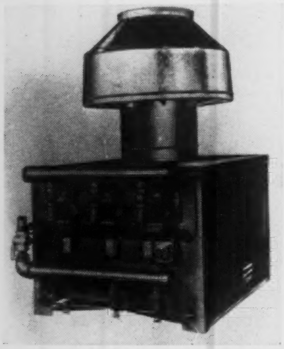
Can be purchased everywhere through your preferred local dealer.

*Determined by method of National Bureau of Standards in H.H.F.A. Research Paper 32.
†Calculated on basis of limiting thermal values cited in Fed. Specs. LLL-f-321b; HH-I-585; HH-I-521c; HH-I-551a.

Infra Insulation Inc., 525 Bway., N. Y., N. Y. Dept. H-9
Please send "Heat Flow by Radiation."

NAME____________________
FIRM____________________
KIND OF BUSINESS____________________
ADDRESS____________________

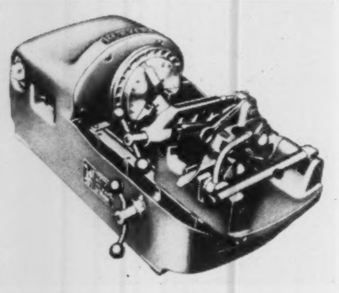
culation in areas where continuous blast of air is needed, is adjustable 60 deg up or down from horizontal, says company. With new aerodynamic blade design, unit is said to produce higher pressure characteristics with lower noise level. In five sizes 24 to 42 in. with 2, 4, 6 or 8 bladed steel or aluminum wheels.



Heating Boiler . . .

. . . with multistage firing facilities—*Laars Engineers, Inc., Dept. HPAC, 13246 Saticoy St., North Hollywood, Calif.*

Multistage firing is said to permit precise temperature control, economy of operation under partial loads. "LCR" available in 17 sizes rated to 2,800,000 Btu input. For natural, manufactured, LP gases. Modified versions available for hot water supply service, swimming pool heating.



Pipe, Bolt Machine . . .

. . . with universal type die head which has three sets of "high speed" steel dies—*Beaver Pipe Tools, Inc., Dept. HPAC, Warren, Ohio.*

"S-4 Speed-O-Matic" threads sizes ½ to 2 in. Is said to be lightweight, fast, powerful, rugged. Pivot mounted cutoff, die heads, reamer swing out of the way when not needed, says company. Oiling tube directs cutting oil to dies. Oil shuts off automatically when tube is moved out of position. Company's "Power Grip" wrenchless chuck standard equipment.

Valve . . .

. . . in combination back pressure and antisuction model for compressor installations—*Norwalk Valve Co., Dept. HPAC, South Norwalk, Conn.*

New diaphragm assembly provides larger capacity, reduced pressure loss, says company. Two soft-seated diaphragms are said to give positive shutoff. Engineered for back pressures to 50 psi in pipe sizes ½ to 6 in.

Roof Fan . . .

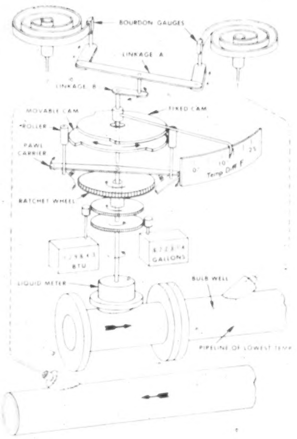
. . . for one-story, flat roof commercial and public buildings—*Allen Cooler & Ventilator, Inc., Dept. HPAC, Rochester, Mich.*

"T-type" low velocity unit's silhouette is only 10⅞ in. high on 420 cfm model, says company. Available in galvanized steel or aluminum with optional automatic dampers.

Mechanical Btu Meter . . .

. . . designed for precision measurement of heat in thermal units, liquid flow in gallons—*Air Conditioning Equipment Corp., Dept. HPAC, 219 E. 44th St., New York.*

"Pollux" Btu integrating unit can measure heat absorbed by liquid or heat removed from liquid; can also measure heating, cooling consumed

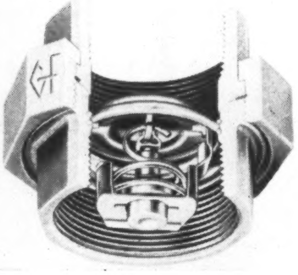


in individual areas, says company. Cited applications: metering of central heating and refrigeration plants; use with liquids encountered in industrial, chemical processes. Consists of liquid meter, integrator.

Filter . . .

. . . for window air conditioners—*American Air Filter Co., Inc., Dept. HPAC, 373 Central Ave., Louisville.*

"Cut-'n'-fit" composed of rigid mat, 15 × 24 in., of continuous strands of green glass fibers that are interwoven, bonded, compressed. Can be easily cut with scissors, snips or knife to size needed, says company.

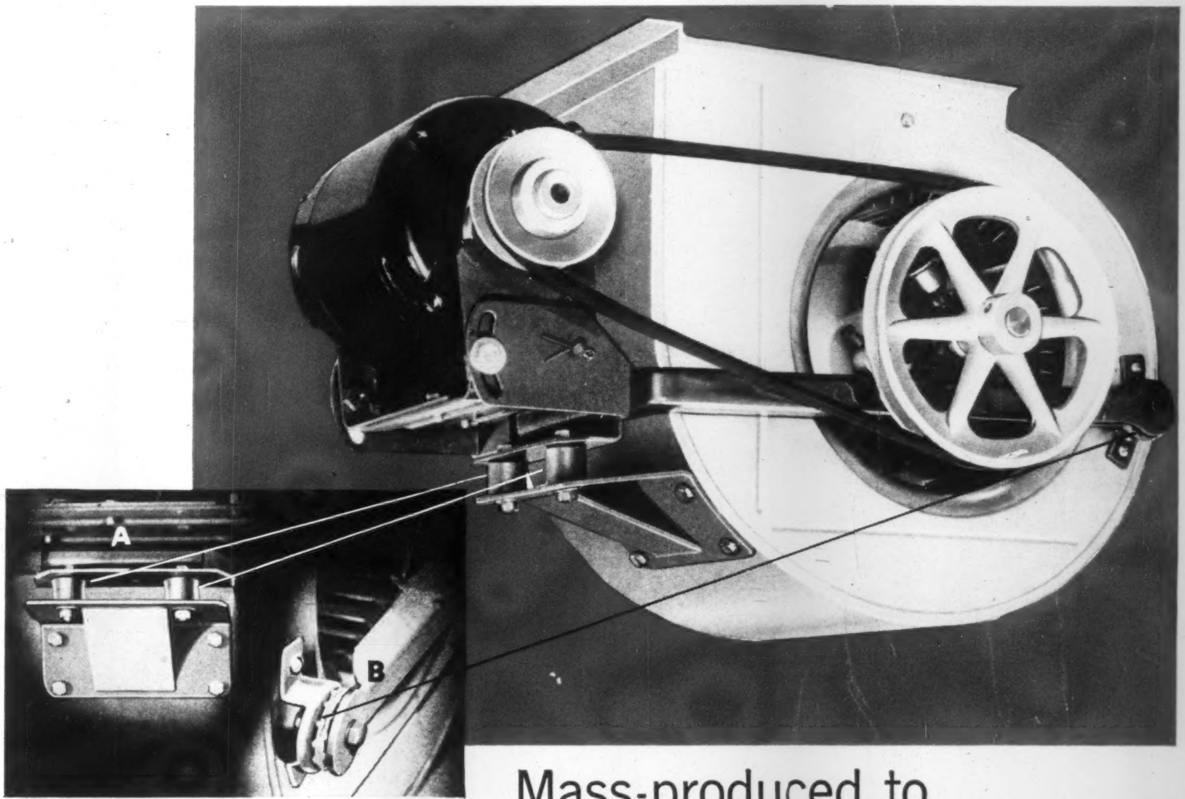


Thermostatic Union . . .

. . . engineered to automatically eliminate interruptions in supply of service of hot water at 140 F from tankless water heaters connected with warm water heating systems—*General Fittings Co., Dept. HPAC, Greenwich, Conn.*

Unit stops circulation of boiler water to radiators if boiler tempera-

US RUBBER ENGINEERED RUBBER PRODUCTS



Mass-produced to exacting specifications

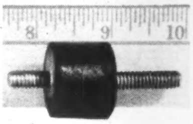
U. S. Rubber Molded Mountings and Connectors help keep blowers operating at "whisper silence".

A well-adjusted system for a forced warm air furnace requires that all vibration and noise be kept to an absolute minimum. In this leading "sulky" type blower, the entire moving parts assembly floats on a cushion of U. S. Molded Rubber Mounts (A) and firm, but movement-free, U. S. Rubber Finger-Flex Connectors (B). In this manner, all mechanical vibrations are isolated—the blower operates in silence.

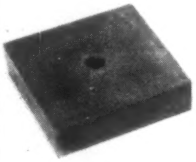
U. S. Rubber Molded Mountings and Connectors were selected because of their ability to retain "molded in" shape during their entire long life and for the economy they provide.

Yet, this is only one of hundreds of applications wherein U. S. Engineered Rubber Products *do jobs no other material can do.* "U. S." engineers will help you solve any molded rubber problem. Contact us at Rockefeller Center, New York 20, N. Y. In Canada, Dominion Rubber Co., Ltd.

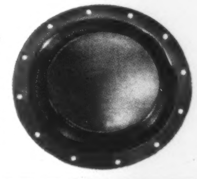
U. S. Molded Shock Mounting for shock absorption when shipping delicate instruments. An electric typewriter manufacturer, for instance, has cut down shipping damage to ½% and cut packaging costs considerably. Improved rubber-to-metal bonding permits their re-use.



U. S. Molded Drop Forge Mounting in service for over 13 years—absorbed *80 million* blows of almost 1600 lbs. force each without wearing out—removed only when steel retaining pins had corroded.



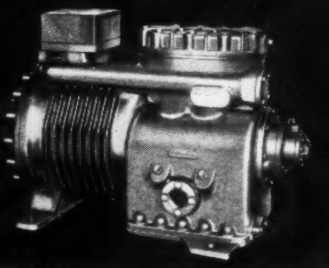
U. S. Molded Diaphragm for controlling liquid flow through motor valves. Offers high burst resistance, retention of molded shape under high pressures, and exact fabric placement.

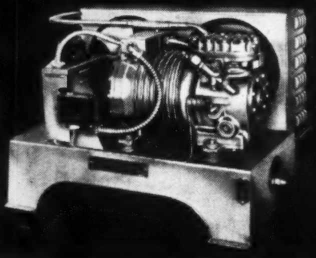


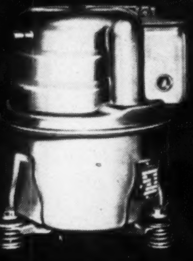
US RUBBER

Mechanical Goods Division

United States Rubber


COPELAMETIC MOTOR-COMPRESSORS


COPELAMETIC CONDENSING UNITS

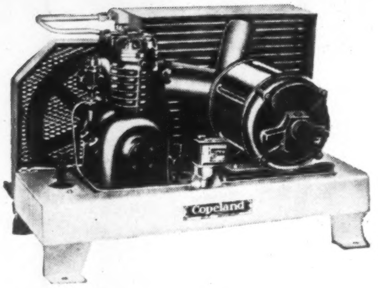

COPELAWELD MOTOR-COMPRESSORS

Copeland quality and service keep users sold on your equipment

Call the roll of America's leading manufacturers of display cases, air conditioners, coolers and related products and you'll find them delighted with their Copeland-powered units. Once they bought Copeland, it has become *"Copeland from here on."*

High quality of Copeland motor-compressors for air-conditioning and refrigeration products is one important factor. But these manufacturers also like our unequaled distribution system . . . nearly 150 wholesalers from coast to coast providing instant parts and replacement service to users of Copeland equipment. Field sales stocks are currently valued at close to $4,000,000.

Now, thanks to our new manufacturing plant—most modern in the industry—the whole Copeland family is in improved position to deliver unexcelled quality with speeded-up service.



BELT-DRIVEN CONDENSING UNITS

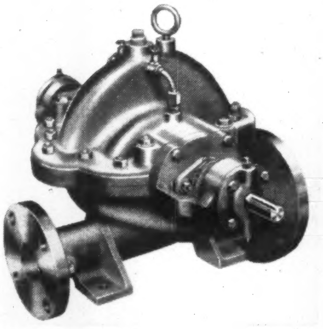
SINCE 1918
Copeland REFRIGERATION CORPORATION
Sidney, Ohio

LIVE BETTER ELECTRICALLY

EQUIPMENT DEVELOPMENTS

Continued

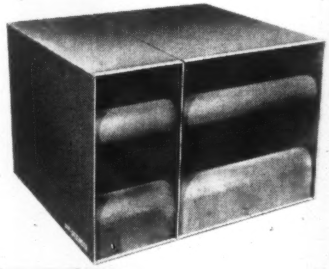
ture drops below 170 F, says company. Is said not to interrupt circulation of adequate temperature boiler water around tankless heater coils. Installation of bypass permits flow through radiation until boiler temperature is restored. In 2 in. size which can be bushed down to meet most hot water boiler requirements.



Split Case Pumps . . .

. . . designed for dependable, efficient, economical performance.—*Carver Pump Co., Dept. HPAC, Muscatine, Iowa.*

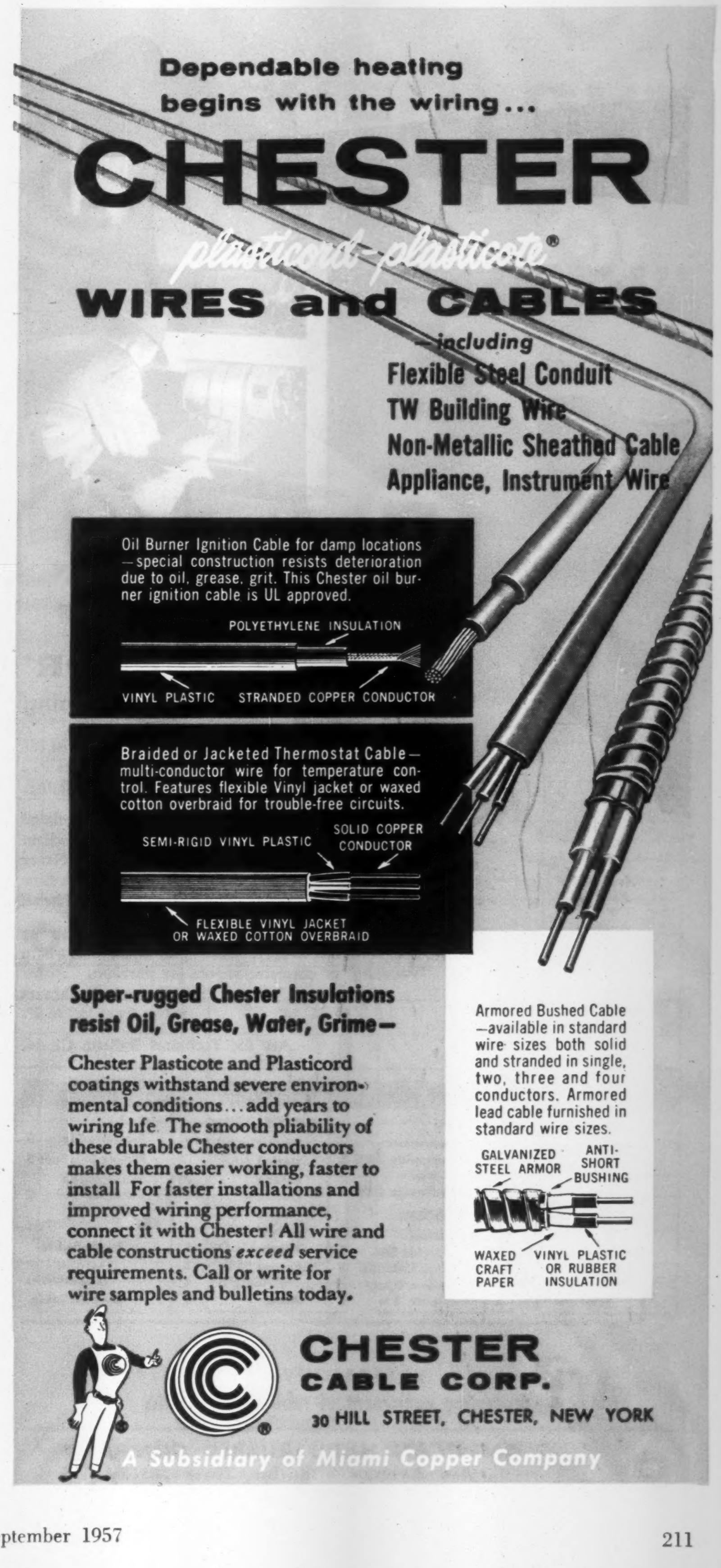
"Series 500" horizontal units available in speeds to 2000 rpm, sizes 2 to 8 in. In models with either stuffing box or mechanical seal. Units said to be very quiet operating. Elimination of sharp curvatures insures smooth performance free from cavitation, says company.



Silencers, Resonators . . .

. . . designed to reduce airborne noise generated by fans—*Elof Hansson, Inc., Acoustical Div., Dept. HPAC, 711 Third Ave., New York 17.*

"Uni-Silencers" may be applied to any noise problem, whether in con-



Dependable heating begins with the wiring...

CHESTER *plasticord-plasticote*® WIRES and CABLES

—*including*

Flexible Steel Conduit
TW Building Wire
Non-Metallic Sheathed Cable
Appliance, Instrument Wire

Oil Burner Ignition Cable for damp locations—special construction resists deterioration due to oil, grease, grit. This Chester oil burner ignition cable is UL approved.

POLYETHYLENE INSULATION
VINYL PLASTIC
STRANDED COPPER CONDUCTOR

Braided or Jacketed Thermostat Cable—multi-conductor wire for temperature control. Features flexible Vinyl jacket or waxed cotton overbraid for trouble-free circuits.

SEMI-RIGID VINYL PLASTIC
SOLID COPPER CONDUCTOR
FLEXIBLE VINYL JACKET OR WAXED COTTON OVERBRAID

Super-rugged Chester Insulations resist Oil, Grease, Water, Grime—

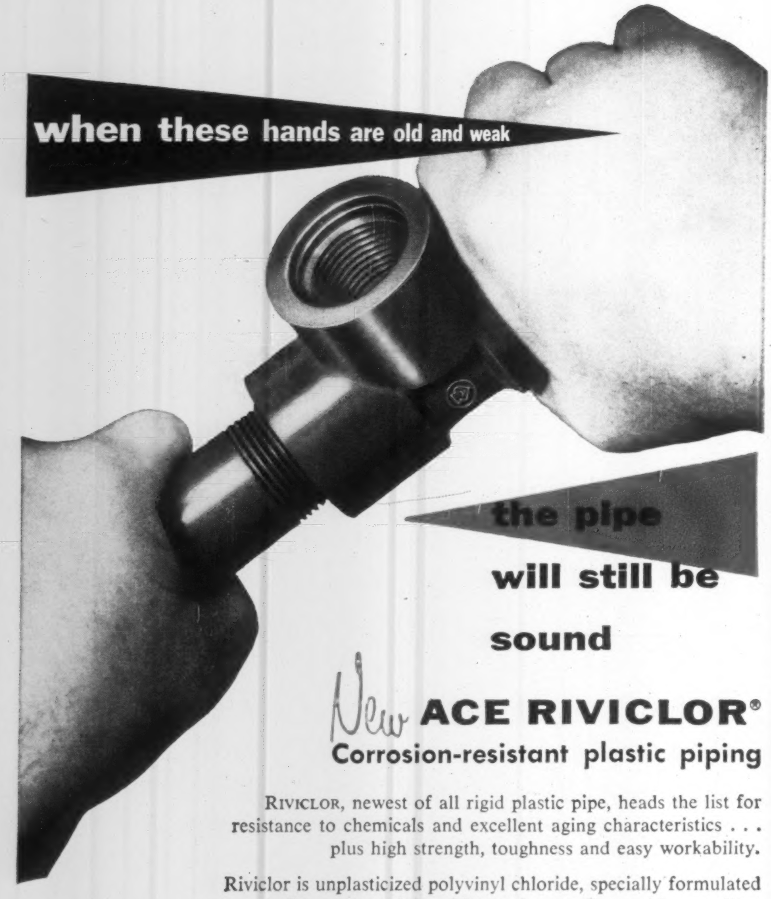
Chester Plasticote and Plasticord coatings withstand severe environmental conditions... add years to wiring life. The smooth pliability of these durable Chester conductors makes them easier working, faster to install. For faster installations and improved wiring performance, connect it with Chester! All wire and cable constructions *exceed* service requirements. Call or write for wire samples and bulletins today.

Armored Bushed Cable—available in standard wire sizes both solid and stranded in single, two, three and four conductors. Armored lead cable furnished in standard wire sizes.

GALVANIZED STEEL ARMOR
ANTI-SHORT BUSHING
WAXED CRAFT PAPER
VINYL PLASTIC OR RUBBER INSULATION

CHESTER CABLE CORP.
30 HILL STREET, CHESTER, NEW YORK

A Subsidiary of Miami Copper Company



New **ACE RIVICLOR®**

Corrosion-resistant plastic piping

Riviclor, newest of all rigid plastic pipe, heads the list for resistance to chemicals and excellent aging characteristics . . . plus high strength, toughness and easy workability.

Riviclor is unplasticized polyvinyl chloride, specially formulated for process piping. Non-toxic, non-flammable, excellent insulating properties. Only half weight of aluminum. Never needs painting. Smooth inner surfaces give you high flow rates with low loss of head.

Use Riviclor for all in-plant piping of mild or strong corrosives at normal temperatures . . . for liquid lines where "sweating" or corrosive vapors are problems . . . for underground piping. Pipe, fittings, diaphragm valves from ½" to 2".

Ask for Technical Bulletin CE-56.

Approved For Use With Drinking Water

ABBREVIATED TABLE OF CHEMICAL RESISTANCE

ACIDS		BASES		MISCELLANEOUS			
Acetic 50%	S	Ammonium Hydroxide 28%	S	Ethyl Alcohol	S	Carbon Tetrachloride	S
Chromic 25%	S	Sodium Hydroxide 50%	S	Methyl Ethyl Ketone	U	Plating Solutions	S
Hydrochloric 38%	S	**HALOGENS**		Gasoline	S	Photographic Solutions	S
Hydrofluoric 50%	L	Sodium Chloride Sat.	S	Mineral Oil	S	KEY: S—Satisfactory	
Nitric 20%	S	Ferric Chloride	S	Animal Oil	S	L—Limited to certain applications	
Sulphuric 50%	S	Sodium Hypochlorite 5%	S	Vegetable Oil	S	U—Unsuitable	
Sulphuric 98%	S			Phenol 10%	S		
				Chlorine 5%	L		
				Alum	S		

ACE processing equipment of rubber and plastics

AMERICAN HARD RUBBER COMPANY
Ace Avenue • Butler, New Jersey
DIVISION OF AMERACE CORPORATION

EQUIPMENT DEVELOPMENTS

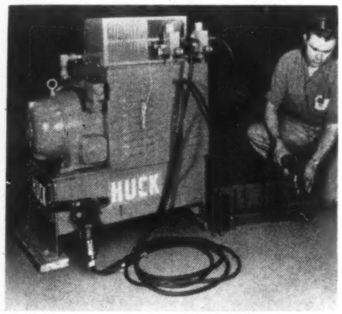
Continued

ventional pressure or high pressure air conditioning or ventilating system, says company. Units designed to be used in multiple when more than one is required. May be put side-by-side and/or on top of each other using slip joints provided. Units weigh 75 lb, measure 24 × 24 × 32 in.

Thermocouple . . .

. . .engineered for greater voltage output—*Grayson Controls Div., Robertshaw-Fulton Controls Co., Dept. HPAC, Long Beach 5, Calif.*

"Super-clad" designed to eliminate service calls caused by needless pilot outages. Is said to insure positive, trouble-free holding action. Improved thermo-electric alloys used to gain increased voltage output, says company.



Hydraulic Power Packs . . .

. . .designed to permit simultaneous operation of two, three or four fastener driving tools at full working pressure—*Huck Mfg. Co., Dept. HPAC, 2480 Bellevue Ave., Detroit 7.*

Jenni Genetron says,

"HERE'S THE RIGHT REFRIGERANT FOR EVERY NEED!"

genetron® SUPER-DRY REFRIGERANTS

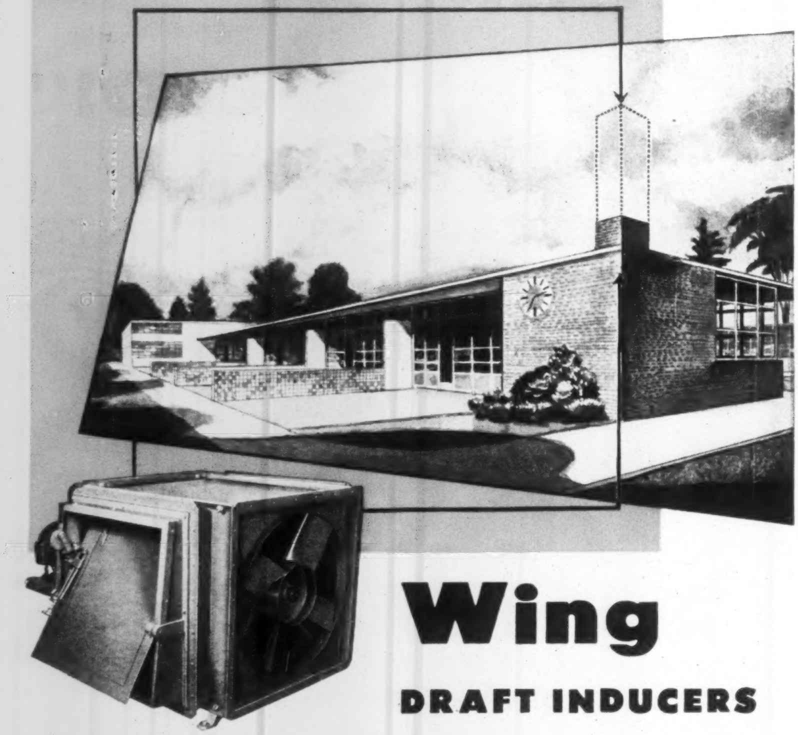
Selected Physical Data (Performance based on 5°F evaporator temperature and 86°F condenser temperature)	Trichloromonofluoromethane **genetron 11** ORANGE LABEL	Dichlorodifluoromethane **genetron 12** WHITE LABEL	Monochlorodifluoromethane **genetron 22** GREEN LABEL	Trichlorotrifluoroethane **genetron 113** PURPLE LABEL	Dichlorotetrafluoroethane **genetron 114A** DARK BLUE LABEL
Chemical Formula	CCl_3F	CCl_2F_2	$CHClF_2$	$C_2Cl_3F_3$	$C_2Cl_2F_4$
Molecular Weight	137.4	120.9	86.5	187.4	170.9
Boiling Pt. (°F) at 1 Atm. Pressure	74.7	—21.6	—41.4	117.6	37.6
Evaporator Pressure at 5°F (p.s.i.g.)	24.0*	11.8	28.3	27.9*	15.6*
Condensing Pressure at 86°F (p.s.i.g.)	3.6	93.3	159.8	13.9*	22.7
Freezing Point (°F) at 1 Atm. Pressure	—168	—252	—256	—31	—76
Critical Temperature (°F)	388	234	205	417	294
Critical Pressure (p.s.i. absolute)	635	597	716	495	478
Compressor Discharge Temperature (°F)	112	101	131	86	88
Compression Ratio (86°F/5°F)	6.24	4.08	4.06	8.02	5.33
Specific Volume of Saturated Vapor at 5°F (cu. ft./lb.)	12.27	1.46	1.25	27.04	4.04
Latent Heat of Vaporization at 5°F (B.t.u./lb.)	84.0	68.2	93.6	70.6	60.2
Net Refrig. Effect of Liquid—86°F/5°F (B.t.u./lb.)	67.5	50.0	69.3	53.7	43.0
Specific Heat of Liquid at 86°F (B.t.u./lb.°F)	0.21	0.24	0.34	0.22	0.23
Specific Heat of Vapor at Constant Pressure of 1 Atm. & 86°F (B.t.u./lb.°F)	0.13	0.15	0.15	0.15	0.16
Specific Heat Ratio at 86°F & 1 Atm. ($k = Cp/Cv$)	1.14	1.14	1.18	1.09	1.01
Coefficient of Performance	5.09	4.70	4.66	4.92	4.60
Horsepower/Ton Refrigeration	0.927	1.002	1.011	0.960	1.025
Refrigerant Circulated/Ton Refrig. (lbs./min.)	2.96	4.00	2.89	3.73	4.65
Liquid Circulated/Ton Refrig. (cu. in./min.)	56.0	85.6	68.0	66.5	88.7
Compressor Displacement/Ton Refrig. (c.f.m.)	36.32	5.83	3.60	100.76	18.78
Toxicity (Underwriters' Laboratories Group No.)	5A	6	5A	4-5	6
Flammability & Explosivity	None	None	None	None	None

*Inches of mercury vacuum.

COMPARE! Careful control at every step in the manufacture of "Genetron" Super-Dry Refrigerants results in products of highest purity, which are extremely low in moisture content and other undesirable impurities. Quality of current production consistently *surpasses* the rigid manufacturing specifications for these products. Write for important informative folder "Genetron Super-Dry Refrigerants."

SEE YOUR WHOLESALER
or write or call
genetron DEPARTMENT
GENERAL CHEMICAL DIVISION
ALLIED CHEMICAL & DYE CORPORATION
40 Rector Street, New York 6, N. Y.

NOW YOU CAN OMIT TALL, UNSIGHTLY, UNNECESSARY CHIMNEYS FROM MODERN SCHOOL DESIGN



Wing

DRAFT INDUCERS

PROVIDE POSITIVE, UNIFORM, ADEQUATE DRAFT AT ALL TIMES

Architects find that "blending" a tall chimney into a low, modern, functional school design is an unworthy compromise. Actually such compromise is unnecessary, for there is no need today for an unsightly chimney. Wing Motorized Draft Inducers provide positive, uniform, adequate draft for boilers or furnaces . . . completely independent of weather conditions. In addition, they save money through higher fuel burning efficiencies. Easily installed in the flue or breeching, Wing Draft Inducers require only enough chimney to vent the exhaust gases. Write for bulletin and special information on school applications.

In confirmation of the above, there are over 500 Wing Draft Inducer installations in schools alone, in all parts of the country, with hundreds more being specified by architects and engineers as the great school building program continues.

L. J. Wing Mfg. Co.
Division of Aero Supply Mfg. Co. Inc.

140 Vreeland Mills Road,
Linden, New Jersey

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Please send me Bulletin SCH-1—Draft Inducers
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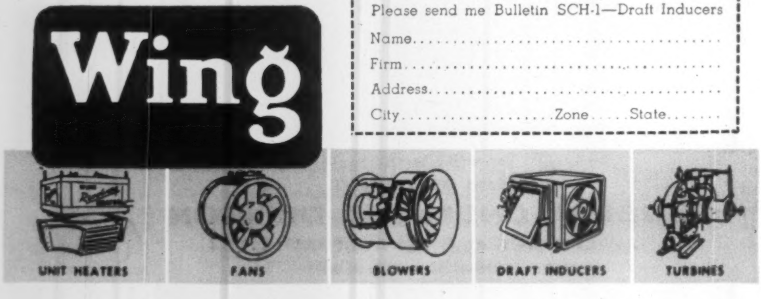
City..................Zone.....State.......

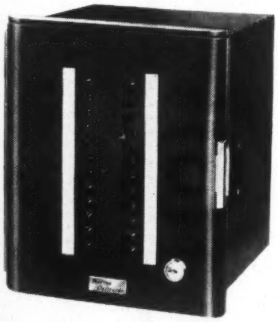
Wing



EQUIPMENT DEVELOPMENTS

Continued

"Series 800" is for use with company's line of standard hydraulic driving tools. "Model 800" has two-gun design, while "801" is for use with as many as four guns. Cited advantage is flexibility in application of driving tool at greater distances from power supply.



Pushbutton Switches . . .

. . . for temperature measuring circuits — *Thermo Electric Co., Inc., Dept. HPAC, Saddle Brook, N. J.*

Designed to permit frequent checking of many remote thermocouples or resistance bulbs from one location. Also permit averaging of temperatures from number of sensing elements, says company. Case capacities range 12 to 72 points for both thermocouples, resistance bulbs.

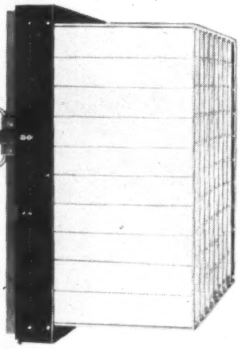
Hard Surfacing Alloys . . .

. . . formulated to deposit tungsten carbides on steel, cast iron, copper alloys without fusion—*Eutectic Welding Alloys Corp., Dept. HPAC, 40-40 172nd St., Flushing* 58, *N.Y.*

"Dril-Tec" rods recommended by company for providing cutting and/or wear and abrasion surfaces on equipment used for drilling, boring, reaming, etc. Three types available with 3/8 in. diameter rods with 1/4, 3/16, 1/8, 3/32 in. carbides as well as in 20 and 40 mesh.

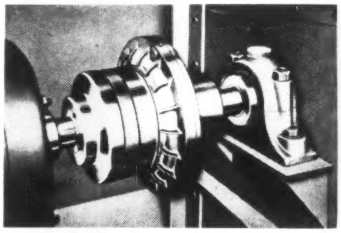
After-Filter . . .

. . . for use with permanent filters where extra air cleaning efficiency is required—*Farr Co., Dept. HPAC,*



P.O. Box 45187 Airport Sta., Los Angeles 45.

"HP" filter, said to be completely flameproof, consists of deep folded pleats of special media permanently attached to chipboard reinforcing panels, says company. Fits into wire retainer which attaches to existing filter holding frames on downstream side.



Dry Fluid Drive . . .

. . . available in larger size for higher horsepowers—*Dodge Mfg. Corp., Dept. HPAC, Mishawaka, Ind.*

New "Flexidyne" model recommended by company for use with motors rated to 75 hp at 1750 rpm. For industrial applications where smooth starting, high efficiency at full load, protection against overload are important factors, says manufacturer.

Press Brakes . . .

. . . with streamlined design, advanced power features—*Niagara Machine & Tool Works, Dept. HPAC, 683 Northland Ave., Buffalo 11.*

Smooth action, instant response assured by power clutch, power brake, power treadle, says company. Elec-

Everlasting Valves are superior for many services

BOILER BLOW-OFF
Quick acting, also handwheel operated "Y" and angle types. For pressures up to 600 psi.

GENERAL SERVICE
Where drop-tight seal and full flow is essential.

CYLINDER OPERATED
Can be remotely controlled, electrically or manually.

STEAM JACKETED
Assures free flow of viscous materials.

WEIGHT-OPERATED
For automatic drains or emergency shut off.

When you want
- quick action
- drop-tight seal
- minimum pressure drop
- straight-through full flow
- self-grinding rotating disc
- valves that cannot wedge or jam

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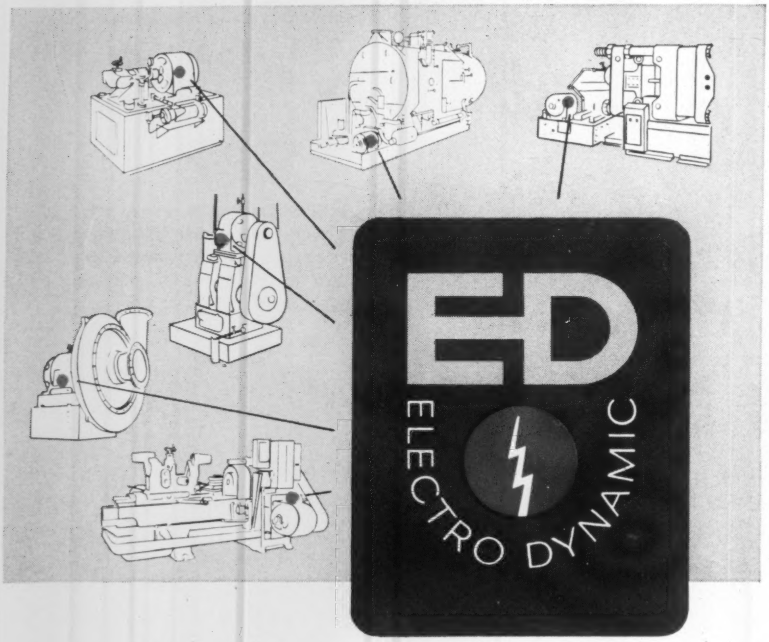
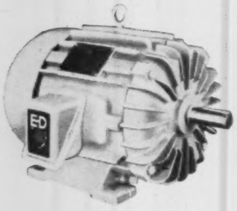
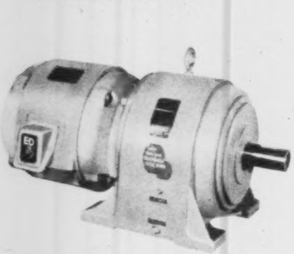
61 FISK STREET, JERSEY CITY 5, N. J.

EV392





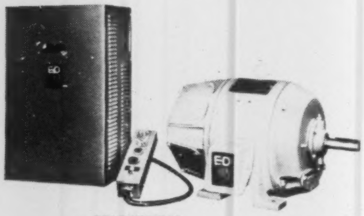
STANDARD MOTORS



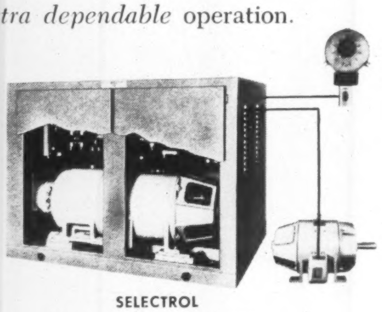
GEAR-ED-MOTORS

THIS EMBLEM IDENTIFIES EXTRA DEPENDABLE INDUSTRIAL MACHINERY

The red *power spot* on industrial machinery means "Powered by Electro Dynamic." Such machinery relies with confidence on the *extra dependability* of Electro Dynamic motors, the proven industrial motors which give industrial equipment *extra dependable* operation.



SELECTRON
VARIABLE-SPEED DRIVES

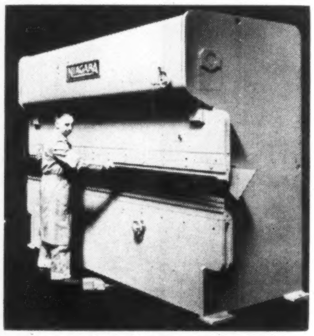


SELECTROL
VARIABLE-SPEED DRIVES

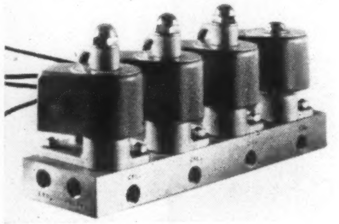
ED ELECTRO DYNAMIC
DIVISION OF GENERAL DYNAMICS
CORPORATION
BAYONNE, NEW JERSEY
GD GENERAL DYNAMICS

EQUIPMENT DEVELOPMENTS

Continued



tro-pneumatic friction clutch and brake work together. Feature is said to permit ram to be inched down smoothly, softly. With totally enclosed construction. Available in 30, 50 ton models with overall lengths 6 to 12 ft. Recommended by company for forming, bending, punching, blanking, related operations.



Solenoid Valves . . .

. . . in two-, three-way models for manifold mounting—*Automatic Switch Co., Dept. HPAC, Florham Park, N.J.*

Construction is said to meet demand for grouping number of solenoid valves on common body, eliminating separate pipe connections to each valve. Any combination may be used when operated from common pressure, return line, says company. May be controlled individually or in combination. For handling air, gas, water, light oil, refrigerants to 212 F. For pressures to 300 psi.

Hydraulic Power Pump . . .

. . . designed for two-speed, fast approach operation—*Greenlee Tool Co., Dept. HPAC, Rockford, Ill.*

"No. 798-AC-SA driven by ¾ hp.

NOVELTY
breaks the
Life Quality Price
barrier
on

SPECIAL FABRICATION

The popular equation that a better product costs more *is now shattered!* For Novelty has broken the Life-Quality-Price barrier on Special Fabrication work with Novelon Linings.

Novelty combines the vast experience of tank and metal fabrication—with a complete range of Novelon Linings that (1) prevent corrosion, (2) protect against contamination, (3) resist heat up to 500° F., (4) outlast metals for chemical receptacles and processing vessels.

If you are planning to have vessels or systems fabricated that require the combined facilities of a modern fabricator and time-tested Novelon Linings—contact Novelty today!

● Specify NOVELTY
THERE'S NO EQUAL

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SUBSIDIARY OF
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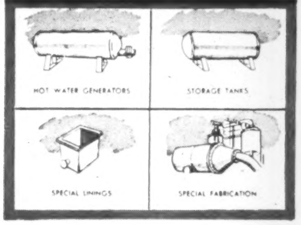

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BUILDERS-PROVIDENCE Shuntflo® Meter helps you get accurate in-plant accounting for cost/tax purposes, detect leakage, and stop waste usage. Self-contained and self-operated . . . easily installed . . . accuracy ± 2% over wide range. NO STUFFING BOX!

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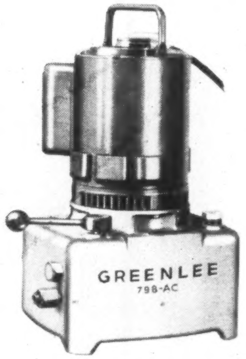
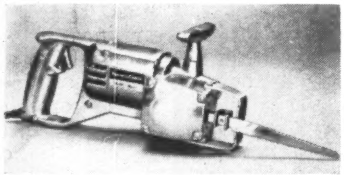


115-230 volt electric motor. Recommended by company for variety of hydraulic power applications, including benders for pipe and conduit. Capable of working at continuous pressure of 6000 psi, unit can develop to 10,000 psi intermittent pressure, says manufacturer.



Multiple Purpose Saw . . .
. . . with orbital motion feature—*Porter-Cable Machine Co., Dept. HPAC, 112 Exchange St., Syracuse.*

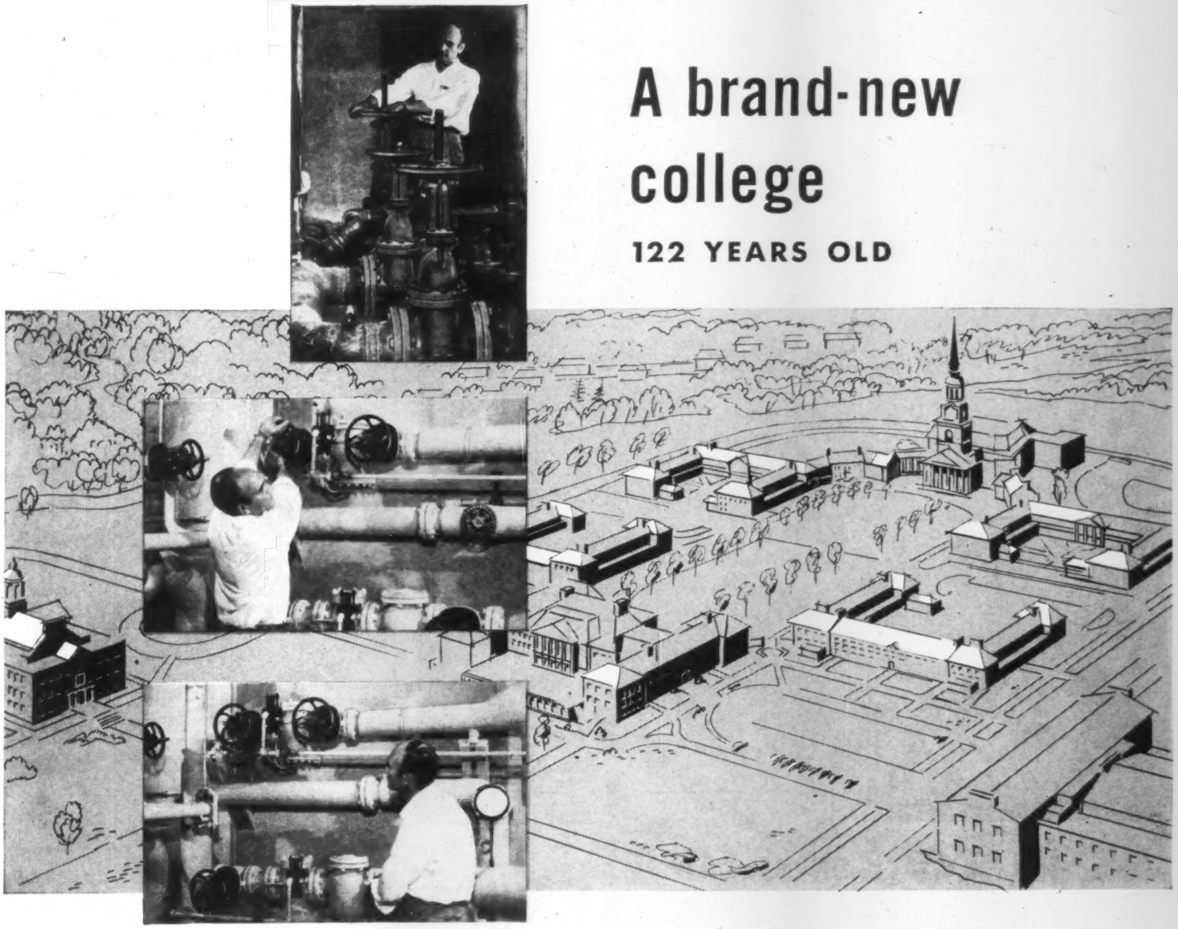
Designed for cutting operations including aluminum, ferrous and nonferrous metals in sheets or tubing, conduit pipe. Uses eight blades. Performance of "Model 531 Multi-Saw" results from orbital action of blade in which blade teeth are in contact only on up or cutting stroke and back away on release stroke, says company. With 3.5 amp motor.

Stainless Union . . .
. . . for use with light wall schedules 5 and 10 stainless steel pipe—*Speedline Stainless Steel Fittings Div., Horace T. Potts Co., Dept. HPAC, 504 Erie Ave., Philadelphia 34.*

New design provides serrated face for gasket material of user's choice, says company. Gasket eliminates

A brand-new college

122 YEARS OLD



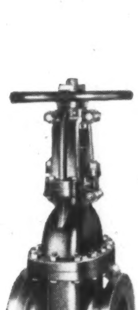
New Wake Forest College campus at Winston-Salem, North Carolina. In 27 of the new buildings OIC Valves have been used exclusively. According to H. S. Moore, Supt. of Buildings and Grounds, OIC Valves have never created maintenance problems for him in all his experience.

and you see OIC Valves everywhere!

Wake Forest College has been transplanted 110 miles from its original site to Winston-Salem, N. C. Its new campus consists of 28 sparkling, modified Georgian buildings, and everywhere you look everything is crisp and modern . . . from its beautifully designed quadrangle to its very last valve.

If you're ever close to Winston-Salem, visit Wake Forest College and enjoy this spectacle of modern design and construction techniques. You may see ideas you'll want to duplicate even down to the very last OIC Valve . . . the always modern, ever dependable, accepted valve line.

Architects: Larson & Larson, Winston-Salem, N. C.
Consulting Engineer: Louis Bouvier, Winston-Salem, N. C.
Materials Furnished by: Atlas Supply Co., Winston-Salem, N. C.



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FOUNDED 1881

VALVES

FORGED & CAST STEEL, BRONZE & IRON, LUBRICATED PLUG VALVES

Holds more weight than any other...
won't pull out of the hole!

Authoritative tests show the *Red Head* Concrete Fastener in the small ¼″ size withstands pull-out loads up to two tons; up to nine tons in a ⅞″ size! Drills its own way into the toughest concrete in seconds . . . *and once it's in—it's in forever* because of full dovetail expansion. Will not pull out, rust out, melt out or shake loose. Costs less installed than any other type concrete fastener, too! We can demonstrate this at your job site. Write for the descriptive, illustrated catalog and free sample

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CONCRETE FASTENER
self-drilling
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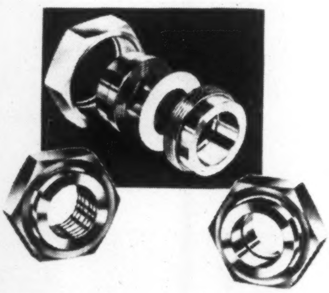
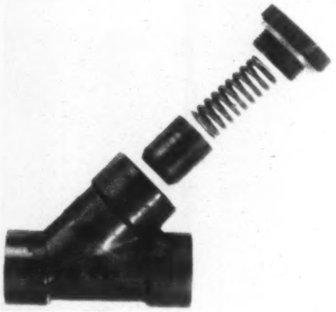


leakage that sometimes occurs with ground joint stainless unions, says company. Unions available in two types: for expanding, in sizes ½ to 1½ in.; for welding or brazing, in ½ to 2 in. Larger sizes on application.



Check Valve . . .

. . . with all plastic construction—*Walworth Co., Dept. HPAC, 60 E. 42nd St., New York.*

Made of normal impact rigid polyvinyl chloride, which is said to provide high corrosion resistance to alkalis, acids, inorganic salt solutions, other corrosive flow material. Durable spring positions disc to assure quick, complete shutoff, says company. For pressures to 150 psi at 75 F. Available for ½ to 2 in. pipe in threaded, solvent weld socket type or flanged ends.

Portable Testing Unit . . .

. . . for general industrial use in at-the-site hydrostatic testing of valves, pressure vessels, piping, steam generators, pump cases, other process equipment to 3000 psi—*Farris Engineering Corp., Dept. HPAC, 563*

...whether you need 2 CIRCUITS *or* 2 DOZEN!

Buy

SPORLAN REFRIGERANT DISTRIBUTORS for Peak Performance *regardless of Load or Evaporator Temperatures!*

Because Only Sporlan with its Famous Interchangeable Nozzle can offer you ALL THESE IMPORTANT ADVANTAGES

It is perfectly adaptable to all refrigerants. The nozzle is removeable for visual, air, or test wire inspection of each individual circuit at both the distributor and coil connection. The nozzle selection can be made at the factory or on the job. The coil manufacturer can stock coils with the distributor already attached and select the proper nozzle later for the conditions specified. The capacity can readily be varied on the job if the application changes or conditions are not as expected.

In addition, Sporlan Refrigerant Distributors offer flare, solder, or flange models with a large selection of number of outlets, circuit sizes and capacities. Brass or aluminum bodies are available for Refrigerants 12, 22 and Carrene 7. Steel or aluminum for Ammonia. They are adaptable to any standard thermostatic expansion valve and are available for high, medium, and low temperature use. They are ideal for OEM units or field built-up jobs. They permit final coil pressure leak test without damage to valve.

So... If you are a packaged unit or coil manufacturer, contractor or service engineer... The Sporlan Refrigerant Distributor, with over 15 years of Peak Performance Leadership, is the one for you! Better still... Install the famous Sporlan combination of Catch-All, Solenoid Valve, and Thermostatic Expansion Valve along with it and get Peak Performance right down the line!

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SPORLAN VALVE COMPANY
7525 SUSSEX AVENUE • ST. LOUIS 17, MO.

EXPORT DEPT. AD. AURIEMA INC., 189 BROAD STREET, NEW YORK 4, N. Y.

DOUBLE MECHANICAL SHAFT SEALS

PERMANENTLY LUBRICATED BALL BEARINGS

These two advanced features of

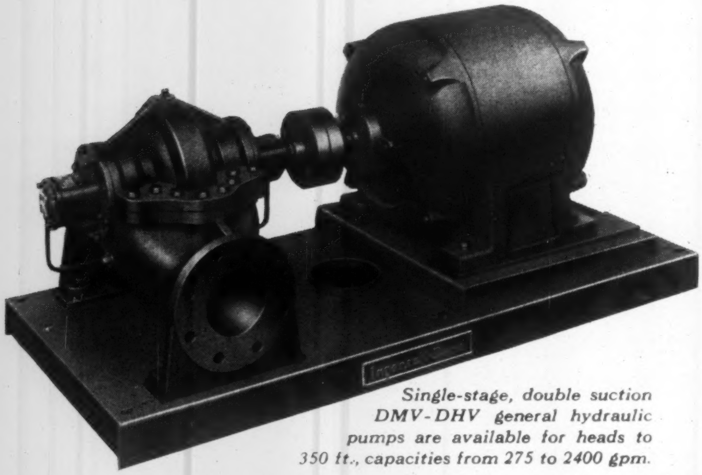
DMV-DHV PUMPS

end pump maintenance problems

Used in place of conventional packed stuffing boxes, Double Shaft Seals eliminate the need for periodic inspections and repackings. Performance-proved and self-adjusting, they require no attention throughout their entire service life.

Sealed, Cartridge-Type Ball Bearings do away with the necessity of greasing or oiling pump bearings. Here, in the DMV-DHV pump, the bearing lubricant is permanently sealed in—and assures years of successful operation.

You can install this modern I-R pump anywhere due to the greater compactness obtained with this modern construction. It is the simplest, most maintenance-free pump ever built by Ingersoll-Rand for general hydraulic service. Write for Bulletin 7248-A, or see your nearest I-R branch office.



Single-stage, double suction DMV-DHV general hydraulic pumps are available for heads to 350 ft., capacities from 275 to 2400 gpm.

Ingersoll-Rand

10-288 Cameron Pump Division
11 Broadway, New York 4, N. Y.

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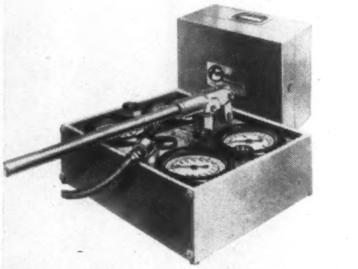
DIESEL & GAS ENGINES • AIR & ELECTRIC TOOLS

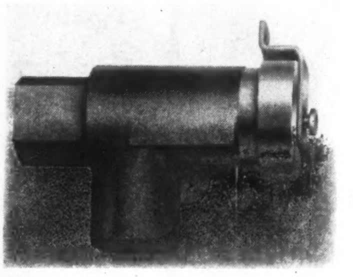
EQUIPMENT DEVELOPMENTS

Continued



Commercial Ave., Palisades Park, N.J.

"Porta-Tester" weighs 55 lb, measures 18 × 14 × 8 in., is contained in carrying case. Includes four gages, 8 ft of hydraulic, flexible tubing that packages in rear of cover. Unit recommended by company for water, other hydraulic fluids.



Valves . . .

. . . for protecting hot water heating boilers—*Patrol Valve Co., Dept. HPAC, 2310 Superior Ave., Cleveland 14.*

In two series: "1000" (¾ in. IPS), "3000" (1 in. IPS). Units have very high Btu ratings in proportion to their size due to manufacturer's "Patrolatron" principle which permits maximum relief at full pipe size, says company. Quick opening and "snap shut" action is said to prevent wire drawing effect, or cutting of either seat or bibb.

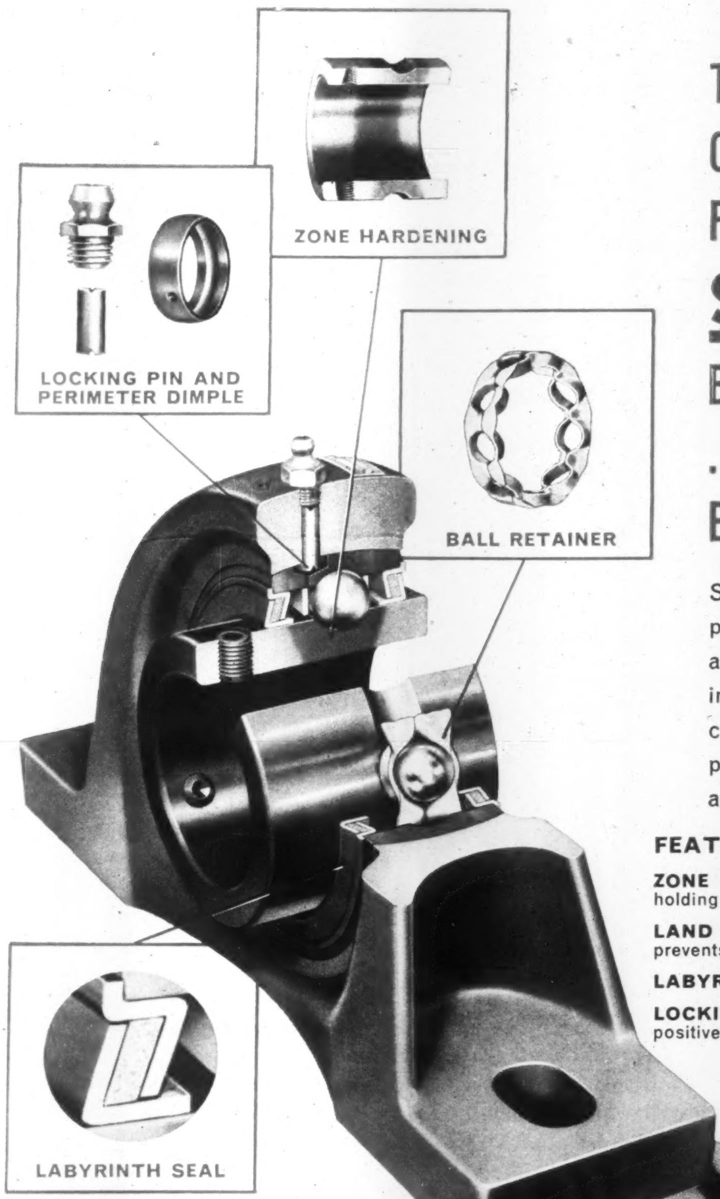
Hammer Tool . . .

. . . engineered to drive threaded studs, pins into steel, concrete, brick —*Fastway Fasteners, Inc., Dept. HPAC, 1676 E. 28th St., Lorain, Ohio.*

"Ham-R-Tool" recommended by

THIS EXCLUSIVE COMBINATION OF FEATURES IS YOURS WITH SEALMASTER BALL BEARING UNITS ...PLUS QUICK, EASY MOUNTING!

Slip a SEALMASTER Ball Bearing Unit into place on the shaft—tighten two set screws and you have the answer to ease of mounting in a bearing unit. SEALMASTER'S exclusive combination of features take over from there, providing smooth, trouble-free performance and long bearing life.


ZONE HARDENING
LOCKING PIN AND PERIMETER DIMPLE
BALL RETAINER
LABYRINTH SEAL

FEATURES:

ZONE HARDENING . . . assures positive race-to-shaft holding power.

LAND RIDDEN BALL RETAINER . . . traps grease and prevents "churning."

LABYRINTH SEAL . . . keeps dust and dirt out, lubricant in.

LOCKING PIN & PERIMETER DIMPLE . . . assures positive lubrication.

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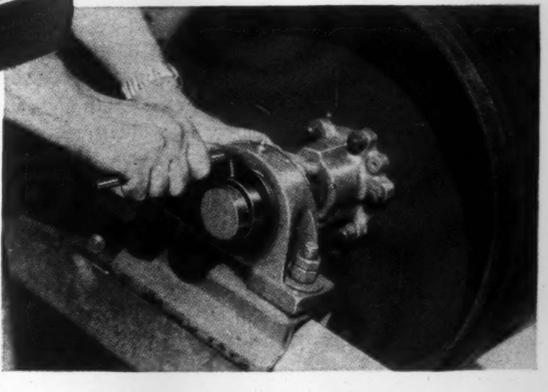
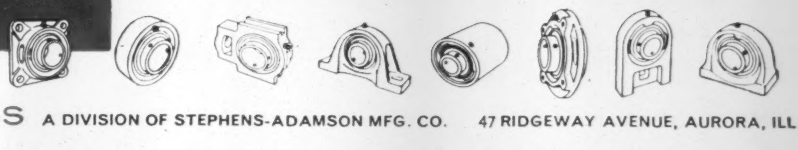
SEALMASTER BEARINGS

Write for Bulletin 454 for full information.



SEALMASTER®

BALL BEARING UNITS



SEALMASTER BEARINGS A DIVISION OF STEPHENS-ADAMSON MFG. CO. 47 RIDGEWAY AVENUE, AURORA, ILL.

A New Line of Branch Connections

W-S COUPLETS

Economical and easy-to-install

Readily modified for small diameter installation

W-S Couplets are designed to function as universal outlet connections for tanks, process vessels and pipelines. They eliminate the need for large, expensive field inventories and costly delays in fabrication.

On most tank, and large piping installations they are used as received. On those few applications where attachment is to be made to a small diameter pipe, the W-S Couplet is easily modified by contouring the welding end with an acetylene torch to mate with the curvature of the pipe diameter. Couplets are made with extra length and heavy wall to permit contouring without detriment to the threaded or socket end.

W-S Couplets are available in sizes ¼″ through 2″, with screw-end or socket-welding dimensions . . . also in a 90° elbow.

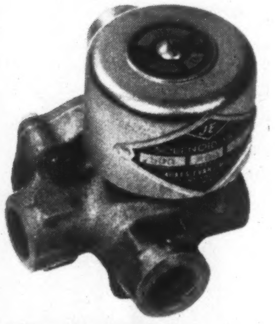
Send for Bulletin CP-1-57. Write to W-S Fittings Division, H. K. Porter Company, Inc., P. O. Box 95, Roselle, N. J.

H. K. PORTER COMPANY, INC.
W-S FITTINGS DIVISION

EQUIPMENT DEVELOPMENTS

Continued

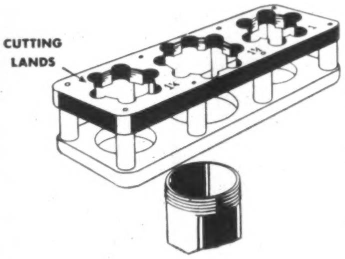
company for hanging sheet metal straps, duct straps, convector type heating units, electrical conduit, etc. Comprised of driving head, drive rod, fastener guide assembly. Powered with $2\frac{1}{2}$ lb sledge hammer. Fasteners available in 11 sizes $\frac{5}{8}$ to 3 in.



Solenoid Valves . . .

. . . in new line of three-way units—*Jackes-Evans Mfg. Co., Dept. HPAC, 4427 Geraldine Ave., St. Louis* 15.

"Series 500" units especially designed for fan coil unit control, are said to provide automatic temperature control for year 'round air conditioning of multiple rooms or areas. Three-way design enables thermostat to control flow of water either through heat exchanger of fan coil unit or to bypass coil. Result is elimination of pump pressure buildup, resulting "fluid shock," says company.



Threading Tool . . .

. . . made specially to thread three sizes of brass tubing—*J. A. Sexauer Mfg. Co., Dept. HPAC,* 2503-05 *Third Ave., New York* 51.

"3-in-1" has three dies that cut

EQUIPMENT DEVELOPMENTS

Continued

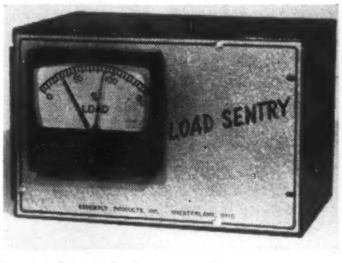
27 threads per in. on 1, 1¼, 1½ in. brass tubing, says company. Designed for extra strength, long lasting service. Provides guide for each die to insure proper alignment with tubing. Companion unit, "5-in-1" tubing holder, grips 1/4, 5/16, 1, 1 1/4, 1 1/2 in. tubing for threading, cutting or flaring. Is said to hold tubing firmly without damaging, distorting.

GF
Perma-Cushion
WATER HAMMER SILENCER
GENERAL FITTINGS COMPANY

Water Hammer Silencer

. . . designed to eliminate noise, damaging effects of water hammer in piping—*General Fittings Co., Dept. HPAC, Greenwich, Conn.*

Surge pressure caused by sudden closing of taps is silently absorbed by neoprene cylinder expanding against cushioning air within sealed brass casing, says company. "Permo-Cushion" available in three sizes for installation on ½, ¾, 1 in. piping.

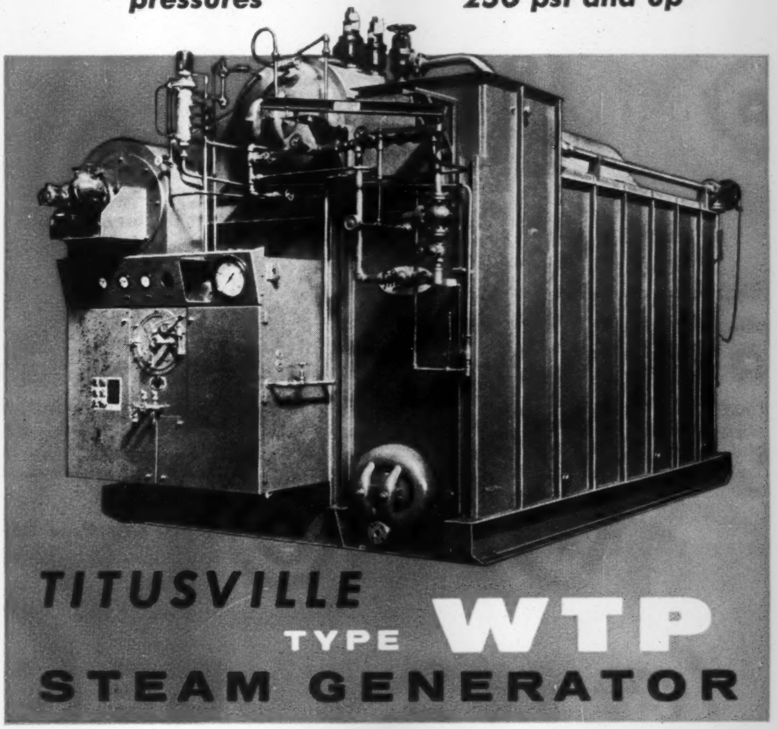


Overload Control . . .

. . . designed to combine accuracy, continual indication of motor load, adjustable load limits — *Assembly Products, Inc., Dept. HPAC, Chesterland, Ohio.*

"Load Sentry" electro-mechanical unit recommended by company for

PERFORMANCE
Meeting Your Most Rigid Requirements—in Capacities
to 60,000 lbs.
pressures 250 psi and up



TITUSVILLE TYPE WTP STEAM GENERATOR

Tops in steam generating performance is matched by outstanding dependability in Titusville's Type WTP Water Tube Steam Generators. Completely factory-assembled, ready to ship by flatcar or truck trailer, Type WTP is easy to install in your boiler-room. • Let us show you why and where Type WTP is serving many of the toughest boiler assignments in the country. When writing, ask for Bulletin 5511.

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BOILERS for Power and Heat . . . High and Low Pressure . . . Water Tube . . . Fire Tube . . . Package Units
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Manufacturers of A Complete Line of Boilers for Every Heating and Power Requirement
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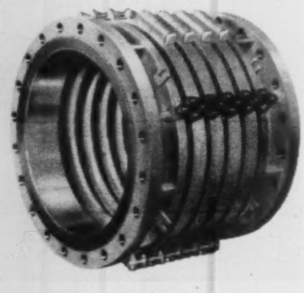
EQUIPMENT DEVELOPMENTS

Continued

use wherever overload of any kind may be registered on electric motor. Built around positive action of contact meter-relay. Hooked into stop-start switches. Dial has 30 divisions ranging zero to 150 percent of normal load.



Expansion Joints . . .

. . . with corrugations designed to share equally movement of power, process piping systems—*Zallea Bros., Dept. HPAC, 815 Locust St., Wilmington 99, Del.*

"Duo Equalizing" units recommended by company for outdoor piping systems, indoor systems operating on frequent on-off cycles to protect piping, related equipment against damage due to temperature change. In stainless steel in sizes 3 to 72 in. diameter. Copper units available in 3 to 24 in. sizes.

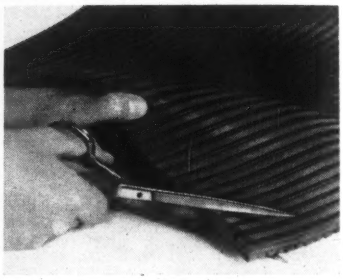
Wire, Cable . . .

. . . for general use in wet or dry locations—*National Electric Products Corp., Dept. HPAC, Gateway Center, Pittsburgh.*

Rubber insulated, fibrous covered wire and cable are said to be heat, moisture resistant. For 600 volt service in sizes 14 to 6 AWG. Recommended by company for application in industrial plants, boiler rooms where heat, moisture may be present.

Mounting Pads . . .

. . . designed to reduce noise, isolate vibration transmitted from industrial machinery, air conditioning equipment—*Vibration Mountings, Inc., Dept. HPAC, 98-17 50th Ave., Corona 68, L.I., N.Y.*



"Shear-Flex" is 18 in. square × 3/8 in. thick oil resistant neoprene sheet with cross-ribbed structure. Is said to offer deflection throughout load range 5 to 70 psi. Can be cut to size with scissors or knife, says company.

Alloy . . .

. . . for welded aluminum vessels, storage tanks, tubes, piping—*Aluminum Co. of America, Dept. HPAC, 798 Alcoa Bldg., Pittsburgh 19.*

"X5154" is said to provide maximum strength for chemical handling

REED

TRADEMARK

● This new Reed Tube Cutter—a faster, lighter-weight roller cutter—is the first cutter for 1" to 3" copper tubing; equally ideal for brass and aluminum tubing from 1" to 3".

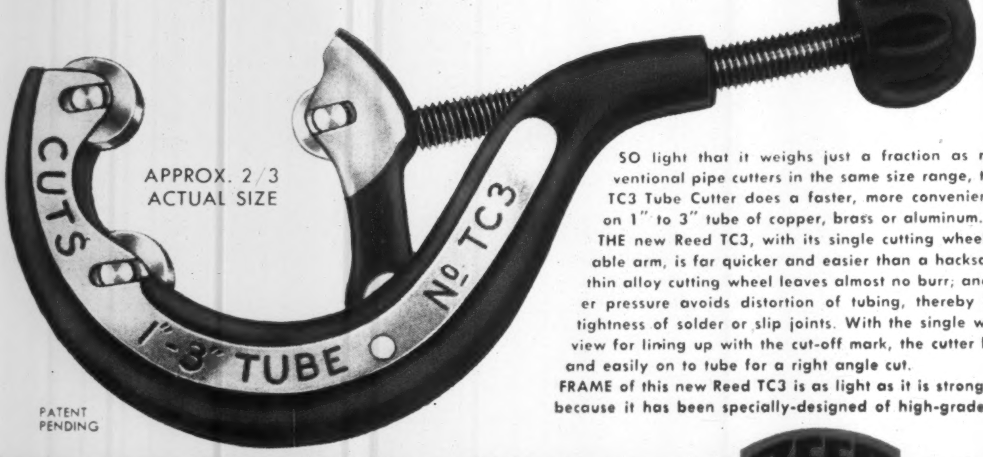
New TC3 TUBE CUTTER!

SO light that it weighs just a fraction as much as conventional pipe cutters in the same size range, this new Reed TC3 Tube Cutter does a faster, more convenient cutting job on 1" to 3" tube of copper, brass or aluminum.

THE new Reed TC3, with its single cutting wheel in the movable arm, is far quicker and easier than a hacksaw; the ultra-thin alloy cutting wheel leaves almost no burr; and TC3's lighter pressure avoids distortion of tubing, thereby safeguarding tightness of solder or slip joints. With the single wheel in plain view for lining up with the cut-off mark, the cutter hooks quickly and easily on to tube for a right angle cut.

FRAME of this new Reed TC3 is as light as it is strong and durable because it has been specially-designed of high-grade ductile iron.

REED MANUFACTURING COMPANY ERIE, PA., REED U.S.A.



Cut down installation costs with

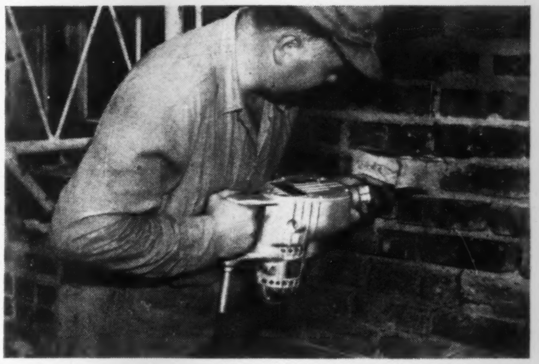
Thor air or electric utility tools

AIR THOR NO.15 UTILITY HAMMER

Thor No.15 is an all-purpose tool which drills, chips or breaks concrete and masonry. Weighs only 14 lbs. Converts instantly from a self-rotating rock drill to a non-rotating hammer with a flick of an external cam lever. Free swiveling hose. Easy lubrication.

This lightweight air tool is really four tools in one. Thor's exclusive stop rotation gives you a light demolition tool, a drill, a light clay digger, a chipping hammer all in one compact tool. It's easy to handle, easy to use and mighty easy on air. Try it and prove its performance on the job.

ELECTRIC THOR U-100 HAMMER



If it's an electric all-purpose tool you need, Thor's U-100 hammer is ideal. The U-100 breaks up concrete or stone—gouges, cuts or shapes wood—chips and scales metal or paint—drills stone, concrete or brick. You can't afford to be without it on any installation job.

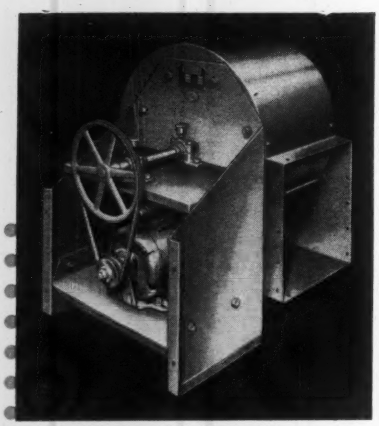
The Thor U-100 hammer is offered with a variety of accessories including: star drill, chisel, bull point, mortar chisel, bush hammer, scaling chisel, web cutting tool, flat wood chisel and wood gouge. This versatile electric hammer delivers a powerhouse punch that's no trouble to handle.

Thor
PORTABLE POWER
TOOLS

Ask your Thor distributor for a demonstration of the No. 15 Air Utility Hammer and the U-100 electric hammer. Also ask to see Thor's complete line of electric tools. Thor Power Tool Company, Prudential Plaza, Chicago 1, Illinois

THOR POWER TOOL COMPANY, CHICAGO

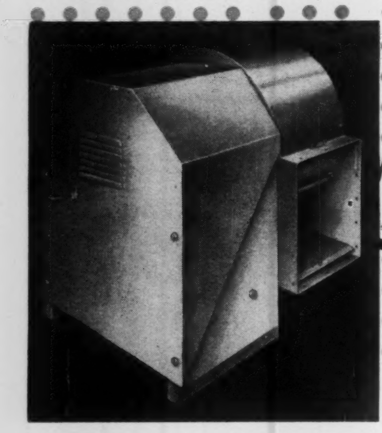
Branches in all principal cities



Aladdin

AIR HANDLING EQUIPMENT

UTILITY SETS



CERTIFIED RATINGS

Certified ratings are the result of tests made by the Manufacturer in accordance with the Standard Test Code for Centrifugal, Axial, and Propeller Fans adopted jointly by the National Association of Fan Manufacturers and the American Society of Heating and Ventilating Engineers.

AUTHORIZED BY NAFM

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TEN SIZES • COMPACT • BELT DRIVEN
SELF CONTAINED • QUIET OPERATING

ALADDIN Belt-Driven Utility Sets are extremely quiet in operation. Designed for general ventilation, they occupy a minimum of space, handling large volumes of air at low noise levels. They are ruggedly built and are ideally suited for roof installation . . . when furnished with weatherproof cover they require no further protection against the weather.

ALADDIN Utility Sets are available with both forward curved or backwardly inclined blade wheels.

Write for complete data

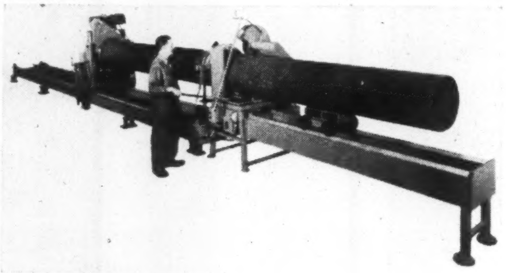
A2-57

ALADDIN HEATING CORPORATION
1111 WEST AVENUE 137 • SAN LEANDRO, CALIFORNIA

EQUIPMENT DEVELOPMENTS

Continued

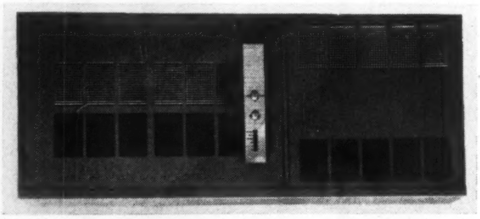
applications where aluminum is exposed continuously or intermittently to temperatures in 150 to 300 F range. Under these conditions, alloy displays high resistance to corrosion, stress corrosion in all temper specifications, says company.



Rotary Cutting Unit . . .

. . . for cutting 20 in. and larger pipe—*Wallace Supplies Mfg. Co., Dept. HPAC, 1304 Diversey Pkwy., Chicago 14.*

Provides cut surface finish suitable for gasket face use. For handling 40 ft (double random length) of pipe with wall thickness of ⅞ in. or heavier provided first cut is 5 in. or more, says company. With hydraulic controls, locking system; electrical chucking device, rotation and cutting units. Larger sizes made to order.



Air Conditioner-Convector Heating . . .

. . . combination system for apartment buildings, hotels, office buildings—*Embassy Steel Products, Inc., Dept. HPAC, 890 Stanley Ave., Brooklyn.*

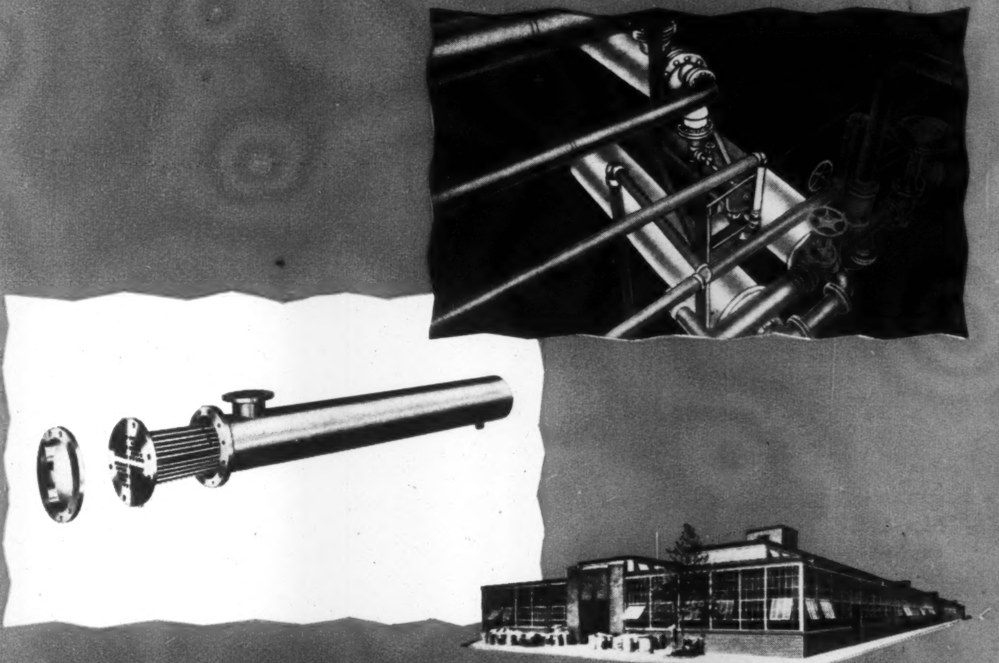
"Weather-Twins" offers following advantages, says company: provides builders with greater immediate profits and more flexible renting opportunities; reduces maintenance costs. While sleeve and cabinets are put in at time of building construction, air conditioning units need not be installed until desired by tenant.

Oxyacetylene Welding, Cutting Outfit

. . . for welding to ⅜ in., cutting to 2 in.—*Linde Co., Div. of Union Carbide Corp., Dept. HPAC, 30 E. 42nd St., New York 17.*

"Prest-O-Lite No. 420" outfit includes blowpipe

ENTIRE BUILDING NOW HEATED WITH STEAM FORMERLY THROWN AWAY!



In this building a large industrial user of steam was dumping the condensate from their steam processing into a creek!

With the installation of the three Taco heat exchangers pictured, they are reclaiming enough steam to heat the entire 220′ x 560′ building.

Perhaps you, too, have a problem involving the use of heat exchangers such as for heating water; showers; cafeterias; processing; snow melting; heating elevated outdoor tank; swimming pools; feed water heaters; condensate cooling; heating buildings remote from the main plant. You are invited to write us concerning *any* heat exchanger problem or application.

BETTER HEATING Taco BETTER WITH TACO **TACO**

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key control
For Commercial Installations

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Adjustable Vertical Front Bars
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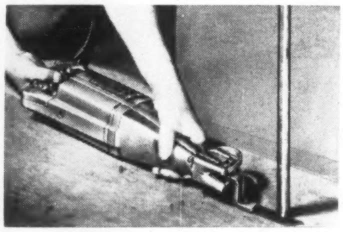
Showing Volume
Control Dampers

Write for Catalog
No. 56 which gives
complete details and sizes
up to 48" x 24"

Always Leading—
Always Progressing

THE INDEPENDENT
REGISTER CO.
3747 E. 93rd STREET • CLEVELAND, OHIO

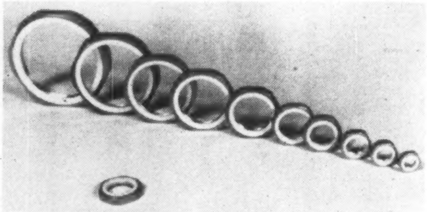
which welds, cuts, heats, brazes without cutting attachment, says company. Blowpipe is said to be redesigned to be easier to use. Kit includes blowpipe, regulators, four interchangeable tips, 12½ ft length twin hose, goggles, friction lighter, wrench, instructions.



Electric Reciprocating Saw . . .

. . . designed to enable user to cut flush with any surface, in any position—*R.C.S. Tool Corp., Dept. HPAC, P.O. Box 661, Bloomington, Ill.*

Bolts, pipes, rods, conduit easily cut flush with surface, says company. Arm reversible for right or left hand cuts. Equipment includes complete line of sawblades. Equipped with ½ hp, 5.0 amp motor. Unit delivers 2500 strokes per min.



Self Sealing Pipe Fitting . . .

. . . designed to be more corrosion resistant, more compact—*Flick Reedy Corp., Dept. HPAC, 2040 N. Hawthorne Ave., Melrose Park, Ill.*

New surface treatment offers increased resistance to corrosion, says company. Edges of nutlike fitting, designed to stop leaks at threaded pipe connections, cropped and rounded off for more compactness. For pressures to 10,000 psi, temperatures −200 to 500 F. In sizes ⅛ to 2½ in.

Insulated Pipe Conduit . . .

. . . for protecting underground steam, hot water systems from corrosion—*Temploc, Inc., Dept. HPAC, Baldwin Park, Calif.*

Prefabricated pipe and fibrous glass insulation protected by strong jacket of spirally wrapped glass cloth and polyester resin. Is said to not be affected by moisture, corrosive electrolytic action of earth.

A New Approach to Perfection

MAINTENANCE-FREE
LIMA MOTORS
IN ALL NEW NEMA FRAME SIZES

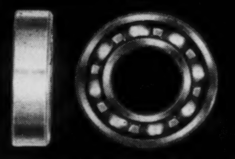
- 30% LESS WEIGHT PER HORSEPOWER
- 30% VOLUMETRIC SIZE REDUCTION
- DUAL FANS INTEGRALLY CAST WITH ROTOR
- COMPLETE ROTOR ASSEMBLIES DYNAMICALLY BALANCED
- RIGID, CAST IRON FRAMES WITH INTEGRALLY CAST FEET
- DIAGONALLY SPLIT CAST ALUMINUM CONNECTION BOXES— CADMIUM PLATED COVER SCREWS
- TOTALLY ENCLOSED FRAMES MEET J.I.C. SPECIFICATIONS

Slash maintenance costs and eliminate costly inspection and lubrication programs with Lima Motors in NEW NEMA frame sizes. With lubricated-for-life DOUBLE-WIDTH ball bearings, solid die cast aluminum rotors with dual integral fans, and Mylar insulation . . . Lima gives you higher full-load speeds with the most complete motor protection available. Install these new Finest Quality Lima Motors—and forget them.

Lima now has in production all ratings in new NEMA frame sizes 182 through 326U. Get complete details on Lima's new NEMA *maintenance-free* motors from your Lima Representative now! If he is not already calling on you, his name and address will be found in *Thomas' Register*, *MacRae's Blue Book* or *Conover-Mast Purchasing Directory*.

Of course, Lima will continue to produce regular NEMA frame sizes 66 to 505 (1/3 to 150 H.P.), incorporating the latest advances in motor design.

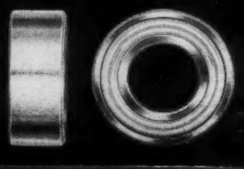
SINGLE-WIDTH UNPROTECTED



THE OLD WAY

Open and unprotected motor bearings subject to contamination and must be inspected and lubricated frequently.

DOUBLE-WIDTH FULLY PROTECTED



THE LIMA WAY

Sealed and protected—Lima's DOUBLE-WIDTH pre-lubricated motor bearings require no attention—just put the motor to work and forget it.

THE LIMA ELECTRIC MOTOR CO., INC., 4991 Findlay Road, Lima, Ohio

Representatives throughout the U. S., Canada and abroad

FIRST . . . FOR MOTORS . . . DRIVES . . . SPEED REDUCERS

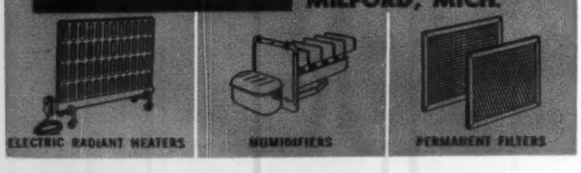
The sign of smooth sale-ing . . . SKUTTLE
brings you NEW
automatic humidification
at less cost

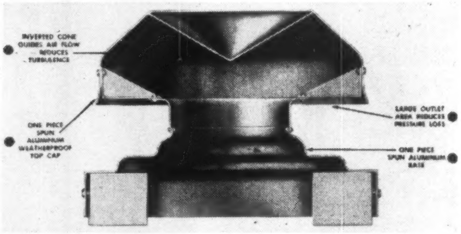
With the introduction of the Model 800 Humi-dial, Skuttle offers automatic humidification at a new, low cost. Here is the electric humidifier for the mass market, with all the capacity of the most expensive unit . . . 24 quarts of water a day . . . but with a price tag that invites comparison!

The Skuttle Humi-dial eliminates the humidistat and relay transformer — is adjusted for proper degree of humidification right at the humidifier. From this point on the operation of the Humi-dial is basically the same as the proven Model 400 Humidimatic. Vapor is produced independent of the heat from the plenum by the use of a 625 Watt element in the water pan. The Model 800 is also equipped for automatic water feed. A new, improved water feeder regulates a constant water volume.

Stock the new Skuttle Humi-dial now and profit from increased automatic humidifier business.

Skuttle MANUFACTURING CO.
MILFORD, MICH.

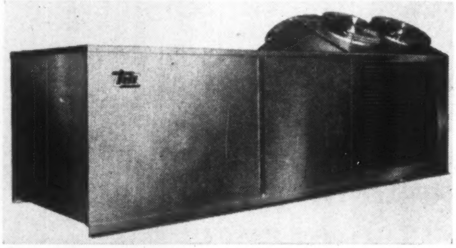

ELECTRIC RADIANT HEATERS
HUMIDIFIERS
PERMANENT FILTERS


INVERTED CONE GUIDES AIR FLOW — REDUCES TURBULENCE
ONE PIECE SPUN ALUMINUM WEATHERPROOF TOP CAP
LARGE OUTLET AREA REDUCES PRESSURE LOSS
ONE PIECE SPUN ALUMINUM BASE

Pressure Relief Ventilators . . .

. . .in nine throat sizes 6 to 27½ in.—*Loren Cook Co., Dept. HPAC, 227 Depot St., Berea, Ohio.*

"Model PR" low silhouette, pressure relief unit can be used as air intake in some applications, says company. Constructed of spun aluminum. Inverted cone in cap guides air flow, is said to reduce turbulence. Available with automatic louvers, motor operated louvers if desired.



Roof Mounted Air Conditioners . . .

. . .in new air cooled, self contained line—*Betz Div., Bohn Aluminum & Brass Corp., Dept. HPAC, Danville, Ill.*

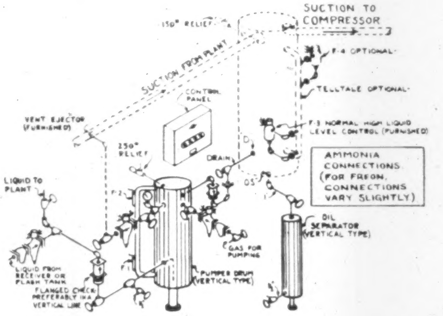
In 3, 5, 7½ ton sizes. Cooling coil in "Model RTA" set at angle to expose maximum surface to air stream, to insure longer contact of air and cooling coil, says company. Large filters are said to insure long periods of operation with minimum maintenance. Designed for direct air conditioning of stores, business offices, small industrial buildings.

ALPHA PVC SOLVENT CEMENT
M.E.K.

PVC Pipe, Fittings . . .

. . .for complete polyvinyl chloride drainage systems to handle corrosive liquid wastes—*Alpha Plastics, Inc., Dept. HPAC, Livingston, N.J.*

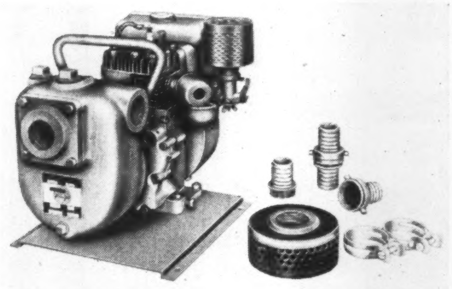
Are said to have smooth internal walls. Designed to eliminate crevice corrosion, provide optimum flow. Pipe, schedule 40 IPS, available in 10 and 20 ft lengths, 1½ to 4 in. nominal sizes. Molded socket type fittings available as 90 deg short Y branch tee, 45 deg Y branch, T-Y cross, coupling, 90 deg short branch cross, socket-to-socket and threaded-to-socket increaser bushings.


SUCTION TO COMPRESSOR
150° RELIEF
SUCTION FROM PLANT
F-4 OPTIONAL
TELLTALE OPTIONAL
CONTROL PANEL
VENT EJECTOR (FURNISHED)
F-3 NORMAL HIGH LIQUID LEVEL CONTROL (FURNISHED)
250° RELIEF
DRAIN
AMMONIA CONNECTIONS (FOR FREON, CONNECTIONS VARY SLIGHTLY)
LIQUID TO PLANT
F-2
OS
OIL SEPARATOR (VERTICAL TYPE)
GAS FOR PUMPING
F-1
LIQUID FROM RECEIVER OR FLASH TANK
PUMPER DRUM (VERTICAL TYPE)
FLANGED CHECK PREFERABLY IN A VERTICAL LINE

Refrigerant Pumping System . . .

. . .for industrial or commercial plant having existing suction accumulator tank in suction line ahead of refrigeration compressors—*J. E. Watkins Co., Dept. HPAC, 307 Lake St., Maywood, Ill.*

Provides advantages of liquid recirculation in plant since system is equivalent to liquid recirculator, says company. Designed for any tonnage, refrigerant. System drains liquid from tank into "pumper" tank. When this is full, system automatically introduces refrigerant gas (at liquid feed pressure) into pumper. Simultaneously, main liquid supply valve is closed off and liquid from pumper feeds plant. Low level control on pumper switches system back to draining by closing off high pressure gas to pumper, opening main liquid feed valve and vent line valve.



Contractors' Pump . . .

. . .in new self priming, portable model—*Lancaster Pump & Mfg. Co., Inc., Dept. HPAC, Manheim Pike, Lancaster, Pa.*

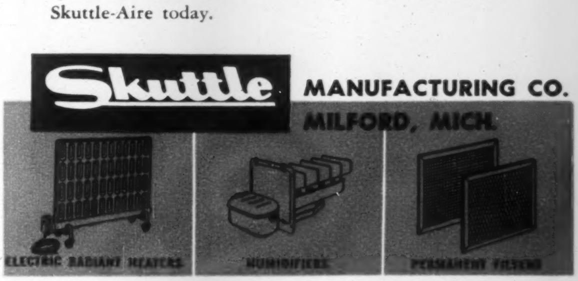
Cited feature is four volute cutoff design said to yield extra high capacities in high pressure range

The sign of smooth sale-ing . . . SKUTTLE
brings you
NEW
permanent filters designed for permanent acceptance

Skuttle-Aire Permanent Air Filters offer you, in addition to the added profits that go with an in-demand product, the kind of consumer satisfaction that builds repeat business . . . establishes you as "the right guy to do business with," an important foothold to gain in this booming filter market in heating and air conditioning!

Skuttle-Aire Filters have been carefully designed to do the best filtering job possible. The quality of materials used along with the sturdy fabrication of a Skuttle-Aire Filter spell out quality all the way through. Compare these features with any other permanent filter on the market: Heavy gauge rigid one piece aluminum frame; expanded metal grills and internal corrugated metal screen for added strength and greater filtering capacity; four layers of Thermo Plastic filtering media —woven of continuous monofilaments for uniform filtration, minimum air resistance, inherent electrostatic properties.

Skuttle-Aire Filters are available in standard as well as special sizes in both 1" and ½" thicknesses. Stock Skuttle-Aire today.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ELECTRIC RADIANT HEATERS
HUMIDIFIERS
PERMANENT FILTERS

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BASEBOARDS—MAINS—UNIT HEATERS—PROCESS WORK

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No. 2-A

No. 70-A

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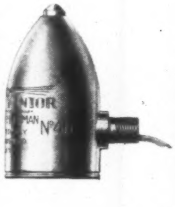

No. 1000

AIR VALVE

No. 500

SPECIAL STEAM VENT

No. 4

CONVECTOR STEAM VENTS

No. 71-A

No. 71-B

No. 71-C

WATER VENTS FOR RADIATORS, CONVECTORS, MAIN

No. 790

No. 791

No. 79

No. 78

MAIN STEAM VENTS

No. 75

No. 75-A

No. 75-H

No. 76

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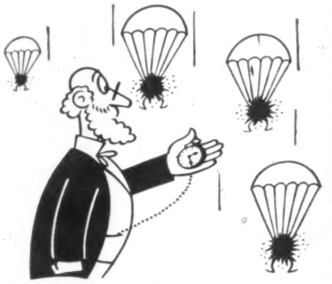
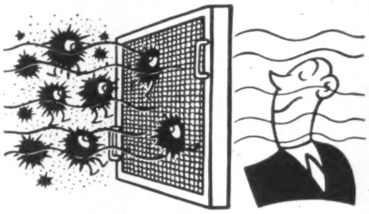
AIR-MAZING FACTS

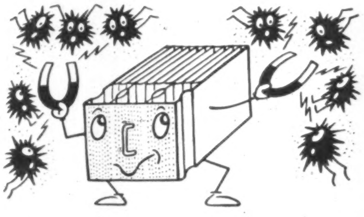
BY O. SOGLOW



LOW-DOWN ON DUST! Microscopic dust particles fall only 100 feet in 278 hours. During this time, a 10 mph wind would carry such dust particles all the way across the United States. Fortunately, you don't have to worry about dust, no matter where it comes from . . . if you use Air-Maze filters to remove harmful particles from air.



BAD AIR GETS FRESH START! Air-Maze air filters keep damaging dust and grit out of hotels, office buildings, stores—wherever clean air is required. Available in a large variety of types and sizes including unit panels, rotating curtains and self-washing electrostatic precipitators.



MAGNETIC PERSONALITY! More than 90% of all air-borne dust and pollen, even smoke particles, are drawn right out of the air by Electromaze electronic air filters. Used from coast to coast wherever super-clean air is desirable, Electromaze filters are more flexible in size, quicker to install and easier to clean.

FOR AIR CONDITIONING AND VENTILATING EQUIPMENT, ENGINES, COMPRESSORS *or any device using air or liquids*—there is an Air-Maze filter engineered to solve each filtering problem. For new all-line catalog, write Air-Maze Corporation, Dept. D-2, Cleveland 28, O.

AIR-MAZE

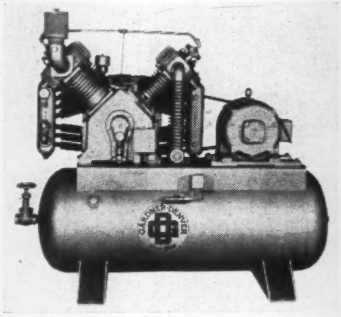
The Filter Engineers

AIR FILTERS • SPARK ARRESTERS • LIQUID FILTERS
SILENCERS • OIL SEPARATORS • GREASE FILTERS

EQUIPMENT DEVELOPMENTS

Continued

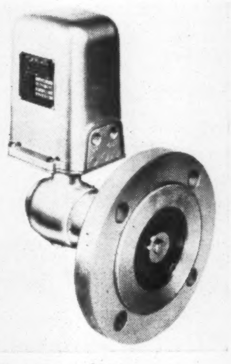
without overloading 2 hp, 4 cycle gas engine. Grease lubricated seal, built-in check valve, steel base, carrying handle, strainer included.



Vertical Compressor . . .

. . . engineered to eliminate need for second compressor when only slightly larger air capacity is needed—*Gardner-Denver Co., Dept. HPAC, Quincy, Ill.*

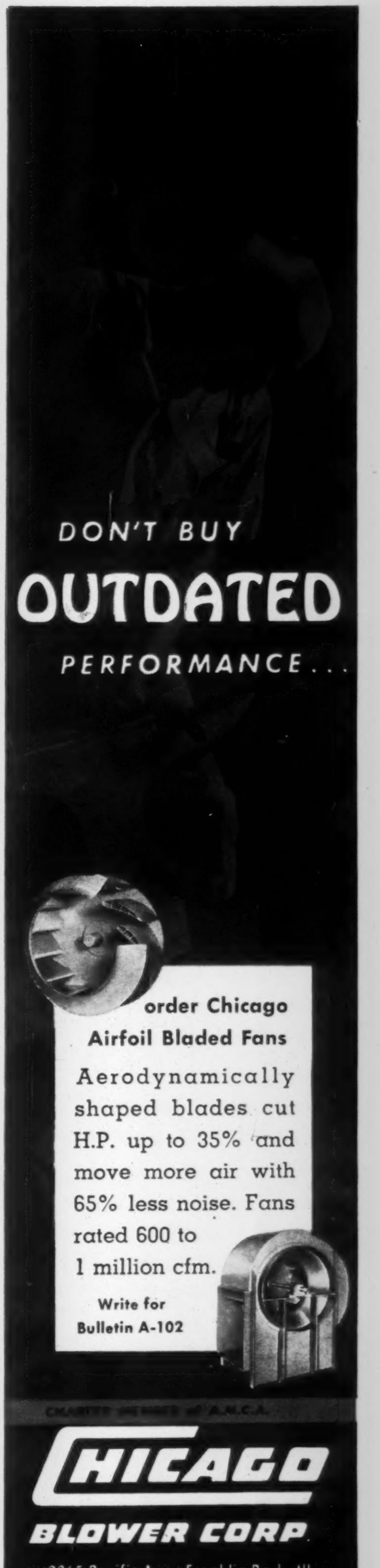
"ADL-1000" is two-stage, air cooled, 20 hp, two-cylinder unit. In continuous service, has piston displacement of 100 cfm at 870 rpm. For up to 150 psi discharge pressure. On intermittent service is suitable for discharge pressures to 250 psi, says company.



Cell Transmitter . . .

. . . for measuring viscous or slurry type liquids in open or closed vessels—*Foxboro Co., Dept. HPAC, Foxboro, Mass.*

"Type 13 FA d/p" differential pressure liquid level unit operates on force balance principle, maintains



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OUTDATED
PERFORMANCE . . .

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Airfoil Bladed Fans

Aerodynamically shaped blades cut H.P. up to 35% and move more air with 65% less noise. Fans rated 600 to 1 million cfm.

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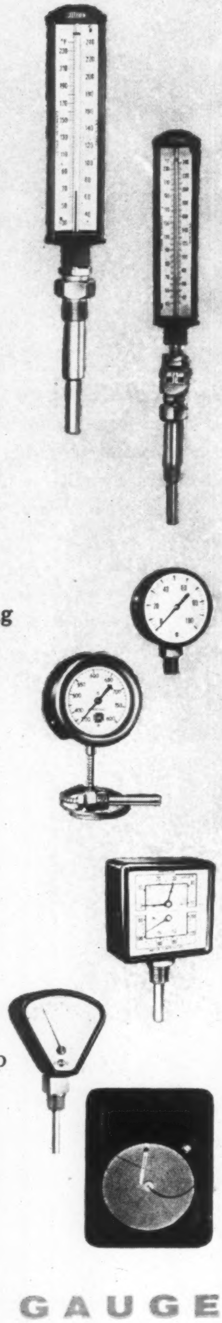
for every heating and air conditioning application



To contractors, heating and air conditioning engineers, and equipment manufacturers, the USG trade mark is synonymous with ACCURACY, RUGGEDNESS, DEPENDABILITY.

Contractors will tell you that gauge for gauge—in every application classification—in every price range—you get more value with USG. These qualities, among others, influence more original equipment manufacturers to specify USG than any other make.

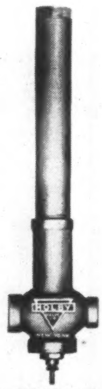
TO CONTRACTORS—Your USG Distributor has in stock, or can get for you fast, any quantity of gauges you want for any application. Consult the yellow pages of your directory or write us for the name of the distributor in your area.

TO EQUIPMENT MANUFACTURERS—For help in keeping your standard gauge and thermometer costs low, or in obtaining special types . . . write either the nearest U. S. Gauge field office or the factory. Our engineering staff and research laboratory are at your service.

USG
UNITED STATES GAUGE
Home of the SUPERGAUGE
Division of American Machine and Metals, Inc.
Sellersville, Pa.

MORE THAN 50,000 TYPES OF GAUGES • SUPERGAUGES • SOLID FRONT GAUGES • RECEIVER GAUGES • TEST GAUGES • RECORDERS • CONTROLLERS • TRANSMITTERS • PSYCHROMETERS • AVIATION INSTRUMENTS

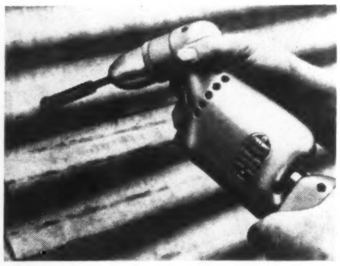
calibrated accuracy over wide range of ambient conditions, says company. Level measuring element is silicone filled diaphragm capsule assembled in 3 in. flange for flush mounting on side of vessel. Head of liquid in vessel applies force to high pressure side of capsule which is opposed by force to low pressure side. With adjustable range suppression, elevation springs.



Tempering Valve . . .

. . . for controlling temperature of hot water—*Holby Tempering Valve Co., Inc., Dept. HPAC, 1146 Second Ave., New York 21.*

Available in new ½ in. size. Existing ¾ in. size redesigned. Complete line now consists of ½, ¾, 1, 1¼, 1½, 2, 2½, 3, 4 in. sizes.



Electric Screw Drivers . . .

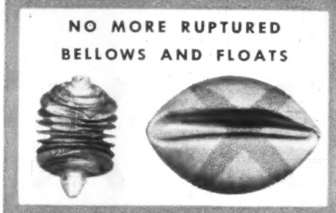
. . . for "All-Angle" use—*Albertson & Co., Inc., Dept. HPAC, Sioux City, Iowa.*

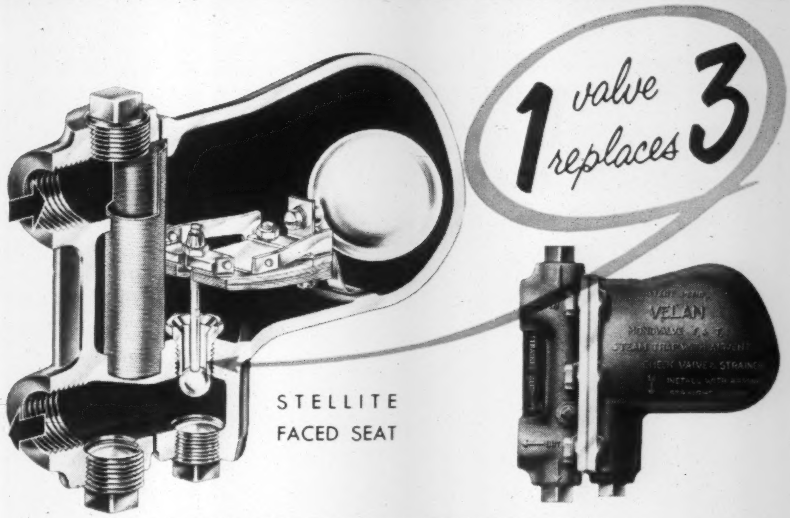
Compact, angle design makes it possible to work in close quarters such as in duct work, which might otherwise be inaccessible for conventional power tool, says company.

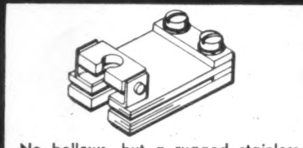
NEW! REVOLUTIONARY!

MONOVALVE FLOAT & THERMOSTATIC TRAPS WITH THE 4-PURPOSE MIRACLE VALVE

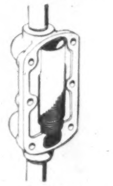
NO MORE RUPTURED BELLOWS AND FLOATS



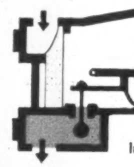

1 valve replaces 3
STELLITE FACED SEAT
VELAN
MONOVALVE F & T
CHECK VALVE & STRAIN



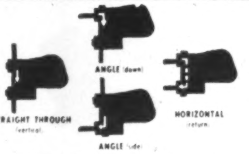
No bellows, but a rugged stainless steel bimetallic element, not affected by water hammer, fatigue or corrosion.



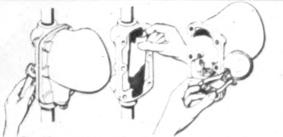
Integral stainless steel strainer reduces initial and installation cost.



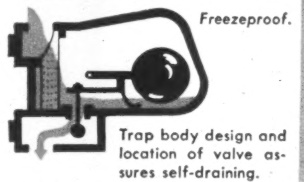
Integral check valve.


ANGLE (down)
STRAIGHT THROUGH (vertical)
HORIZONTAL (return)
ANGLE (side)

Dual inlet and outlet for most convenient installation.



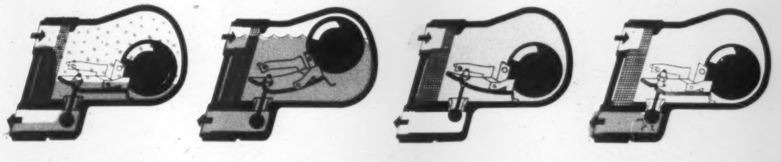
Easily serviced, only 6 screws to remove to inspect or replace working parts.



Freezeproof.

Trap body design and location of valve assures self-draining.

HOW IT WORKS



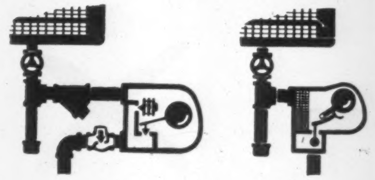
AIR VENT AND CONDENSATE DISCHARGE

STEAM-HOT CONDENSATE DISCHARGE

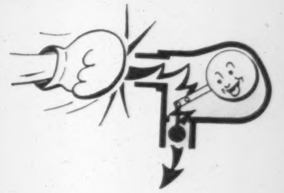
STEAM TRAPPING

ACTS AS CHECK VALVE

WHAT IS NEW?



1 seat, valve and mechanism combines the function of 3 seats, valves and devices in standard installations.



NOT AFFECTED BY WATERHAMMER

MAIL THIS COUPON TO-DAY

VELAN VALVE CORPORATION
37 SOUTH RIVER ST., PLATTSBURGH, N.Y.

☐ Please send me more information on your Monovalve Steam Trap

☐ Please send me 1 Monovalve F & T Trap for "30-day free trial"

Size.................... Pressure....................
NAME....................
POSITION....................
FIRM....................
ADDRESS....................
CITY.................... STATE....................

VALVE CORP.
37 South River Street,
Plattsburg, New York

• • •

Velan Engineering Ltd.
2125 Ward Ave., St. Laurent.

666
adds up to
New York's
most exciting
new building

Tishman Realty & Construction Co., Inc. — Owners & Builders. Carson & Lundin — Architects. Victor Mayper & Associates—Engineers.

featuring complete—quiet Air Conditioning thanks to

Quiet Duct

Your Standard of Silence

Latest addition to the New York Skyline, 666 Fifth Avenue silenced its air-conditioning and ventilating system *in the design stage* with rated IAC Quiet-DUCTS! Pre-fabricated in as many as 148 sizes, these economical Quiet-DUCT units, measuring in length from 2 to 10 feet, provide as much noise control as a conventional lined duct measuring from 30 to 100 feet long!

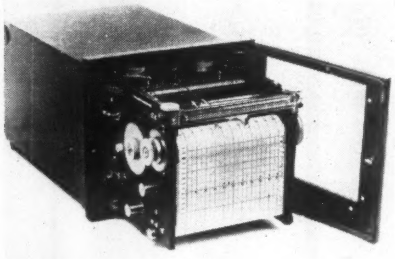
COMPLETE DATA AVAILABLE

Write today for a complete set of data sheets and catalog describing prefabricated "Quiet-DUCT" units.

INDUSTRIAL ACOUSTICS COMPANY, INC.

Specialists in Noise & Pulsation Control

341 Jackson Avenue, New York 54, N.Y. CYpress 2-0180



Recording Potentiometer . . .

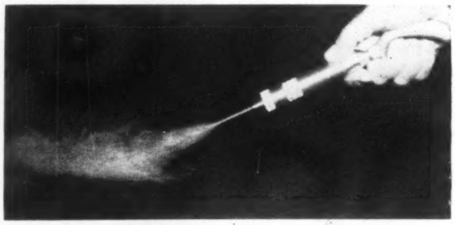
. . . with two pens both writing margin-to-margin on single 5 in. strip chart—*Westronics, Inc., Dept. HPAC, 3605 McCart St., Ft. Worth, Tex.*

Is said to produce two continuous records in smaller space. Available with one front set limit switch, three back set limit switches on each pen. Amplifiers are transistorized, requiring less volume and maintenance than ordinary vacuum tube amplifiers, says company.

Portable Electric Convector . . .

. . . in three sizes to 1660 watts—*Embassy Steel Products, Inc., Dept. HPAC, 890 Stanley Ave., Brooklyn.*

Cited features: user cannot be burned by frame; no working parts subject to breakdown; removal handle allows unit to be recessed into wall or carried wherever desired. Heat thermostatically controlled to permit dialing of desired temperature. Pilot light indicates on-off cycle. Made of aluminum tube, aluminum fins.



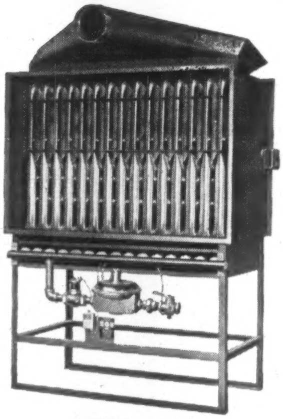
Smoke Generator . . .

. . . for analyzing air flows relative to ventilation—*Design Engineers, Dept. HPAC, 214 S. Church St., Rockford, Ill.*

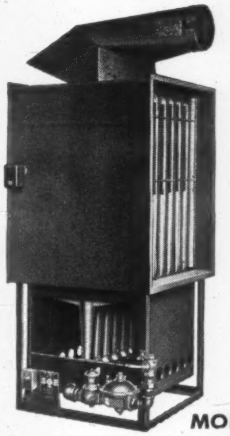
"Smokey" is portable, manually operated unit. Is of double wall construction to facilitate cooling and generates and directs considerable amount of smoke using cigarette as fuel medium, says company. Recommended by manufacturer to heating and air conditioning contractors, engineers.

Portable Power Pipe Threader . . .

. . . designed to reduce threading time—*Velocity Power Tool Co., Div. of Mine Safety Appliances Co., Dept. HPAC, 201 N. Braddock Ave., Pittsburgh 8.*



MODEL SED-E

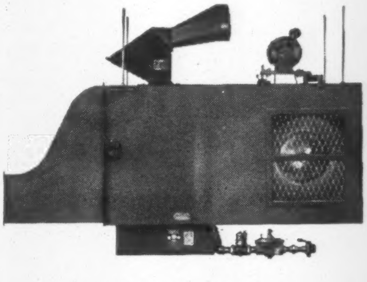


MODEL SED-S

MODEL SED-VF

MODEL SED-E — Non-corrosive type 321 stainless steel heat exchanger. Permits installation downstream of cooling equipment, for continuous blower operation. Air throughput in either direction. 80,000 to 600,000 Btu input.

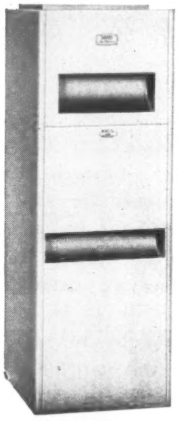
MODEL SED-S — Same as SED-E except controls are at the side, instead of at the end where accessibility requires. Either SED-E or SED-S is available in sizes from 80,000 to 600,000 Btu input in increments of 40,000 Btu.



MODEL SEU

MODEL SED-VF — Tested and approved as a duct furnace; type 321 stainless steel. Re-circulated or fresh air enters through bottom, sides, or back. Built-in air bypass, vent in front. Sizes from 70,000 to 245,000 Btu input.

MODEL SEU — Suspended unit heater. Recirculates room air. Diffuser outlet with adjustable vertical and horizontal vanes. Double inlet forward curve blower. Continuous duty, variable pitch drives, raised port burners. 80,000 to 600,000 Btu input.



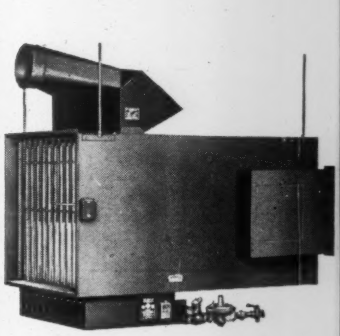
MODEL SEC

HAYES

FURNACES

outstanding for commercial, industrial, schools, churches, theaters, large residential

HAYES FURNACE MFG. & SUPPLY CO.
3233 So. La Cienega Blvd., Los Angeles 16, California
Telephone TExas 0-3734



MODEL SES

MODEL SEC — Forced air furnace. Stainless steel heat exchanger sections seam and arc welded. One piece cast iron burners with drilled ports. Oversize double inlet blower, glass or washable filters. 6 sizes — 70,000 to 245,000 Btu input. For zero clearance.

REPRESENTATIVES

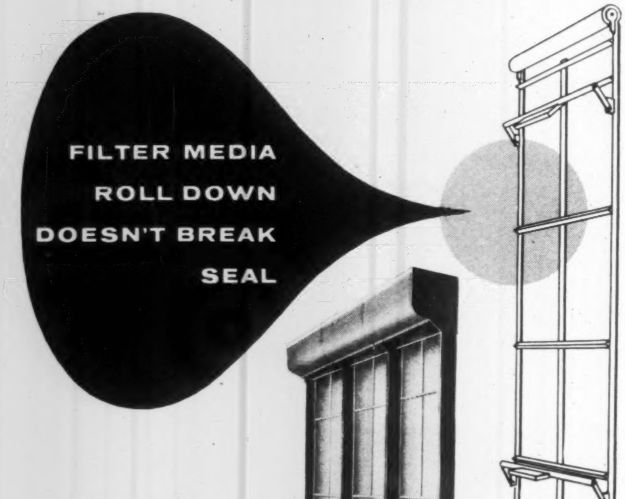
M. Blazer & Son, Passaic, New Jersey.
Blue Flame Supply Company, Atlanta, Georgia
Sinclair Heating Supplies, Ltd., Edmonton, Alberta, Canada.

Boyd Engineering Co., El Paso, Texas.
Reube O. Emery, Nashville, Tennessee.
F & D Distributors, Salt Lake City, Utah.
Leudecke Engineering Co., Austin, Texas.
McCombs Supply Co., Denver, Colorado.
O'Connor-Oklahoma Co., Oklahoma City, Tulsa, Oklahoma & Wichita, Kas.
Smith Steam Specialty Co., Kansas City, Mo.
Tay-Holbrook, Inc., San Francisco, California.
F. R. Young, Houston, Texas.
Dealers Supply Company, Atlanta, Georgia.
J. C. Lewis Company, Little Rock, Arkansas.
Nunn Electric Co., Lubbock, Texas.
Noland & Co., Newport News, Va.
Temp-Control Corp., Portland, Oregon

MODEL SES—Forced air, suspended furnace for installation in suspended duct system. Inlet and outlet designed for sheet metal duct connection. Double inlet forward curved blower. Continuous duty variable pitch drives, raised port burners.

GREEN Sure Seal*

air filter



It doesn't help very much when a shot of contaminated air sneaks around the seal when an air filter automatically changes plugged media to fresh media. The unit should be kept sealed at *all* times.

With the GREEN *Sure Seal* AIR FILTER, a floating tubular frame seals the media against the panel frame *at all times*, even when the media is being rolled down to provide fresh cloth . . . indexing, as we call it.

Perhaps this is the most important factor for you to consider in your plans for an air filter. If you need filtered air you need it *all* the time. You just can't allow the unit to be "off duty" while indexing.

We suggest you look into the merits of the GREEN *Sure Seal* AIR FILTER for your clean air requirement.

Clean Air
GREEN'S AIR FILTER

Send for

BULLETIN 175

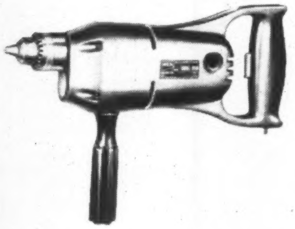
All the details including capacity and dimensional data are given.

*U. S. Patents Pending

You can have confidence in the Green Line of products— which have been world-wide since 1845.

THE GREEN
POWER AND PROCESS PLANT EQUIPMENT
FUEL ECONOMIZER COMPANY INC.
BEACON 3, NEW YORK
Representative in Principal Cities

After connection to 110 volt a-c or d-c circuit, 20 lb "Lawco" employs 3/4 hp electric motor that drives threading die. Equipped with toggle switch to provide reversible power. Can also be used as general purpose power tool, says company.



Power Drill . . .

. . . in new two-speed, 3/8 in. model—*Wen Products, Inc., Dept. HPAC, 5808 Northwest Hgwy., Chicago 31.*

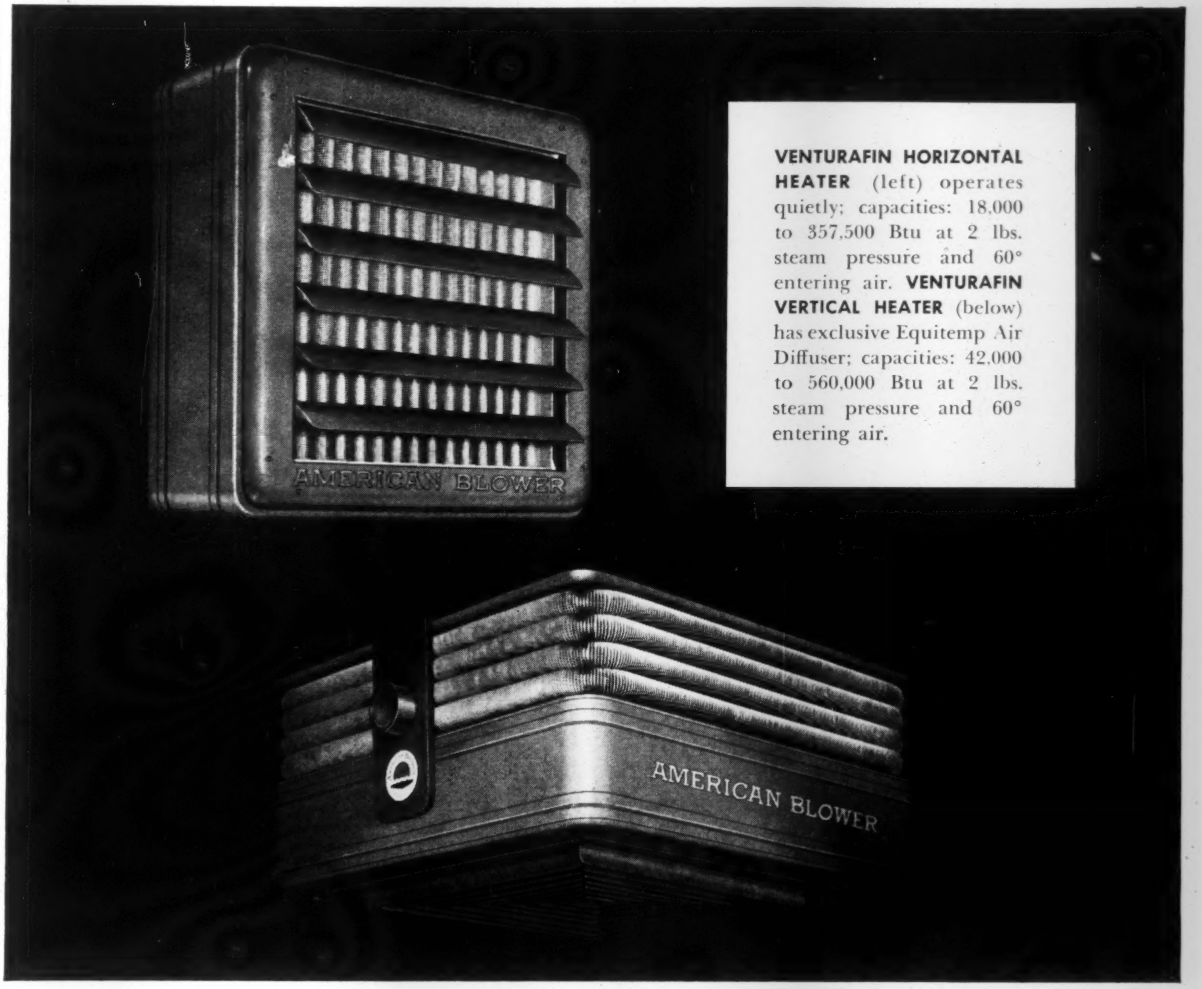
At 3000 rpm: designed for drilling through steel to 5/32 in. and aluminum, brass, copper to 1/4 in. At 1000 rpm: for heavier material and masonry or concrete to 1/2 in. Speed change is said to be easy, quick, positive. 115 volt, a-c/d-c, 2 amp motor delivers maximum torque under load, says company.

Gasketing Materials . . .

. . . formulated to make it possible to obtain seals at lower flange pressures—*Armstrong Cork Co., Industrial Div., Dept. HPAC, Lancaster, Pa.*

Five new high density fiber materials available for various pressures, temperatures.

AMERICAN BLOWER HEATING EQUIPMENT



VENTURAFIN HORIZONTAL HEATER (left) operates quietly; capacities: 18,000 to 357,500 Btu at 2 lbs. steam pressure and 60° entering air. **VENTURAFIN VERTICAL HEATER** (below) has exclusive Equitemp Air Diffuser; capacities: 42,000 to 560,000 Btu at 2 lbs. steam pressure and 60° entering air.

Select American Blower Unit Heaters for top quality at competitive prices

Now that American Blower is combining its usual high quality with prices that rank with the lowest, you're 'way ahead when you choose Venturafin Unit Heaters. Sturdy and attractive, they are quiet and built for enduring service.

Available as either vertical or horizontal units, Venturafin Heaters give you your choice of steam or hot-water coils, plus a wide range of sizes and capacities. Fact is, with American Blower Gas-Fired Heaters and Cabinet Heaters, too, you can meet the heating requirements of any job.

So, for top performance on your next heating job, select easy-to-install American Blower Unit Heaters. For more information, contact your nearest distributor, or write us direct today. American Blower Division of American-Standard, Detroit 32, Michigan. In Canada: Canadian Sirocco products, Windsor, Ontario.

AMERICAN BLOWER

Division of American-Standard

QUALITY PROTECTS YOUR INVESTMENT...
AMERICAN-Standard QUALITY IS AVAILABLE AT NO EXTRA COST

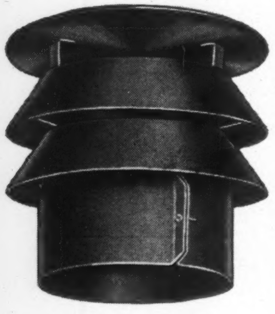
Two Ways to Bigger Profits!

Sell the People's Choice!

FEDERAL FILTER
MODEL A77
PAT PENDING
UL
REPLACE CARTRIDGE EACH HEATING SEASON
MFG. BY NORWOOD PRODUCTS CO.
DIVISION OF
A. R. WOOD MFG. CO. LUVERNE, MINN

Federal Filter

Look at these unsurpassed benefits. Federal's 16 extra-large filter pockets trap the contaminating impurities found in fuel oil and prevent clogging of burner nozzles. This means trouble-free furnace operation and the end of expensive service call-backs. One model handles all filtering jobs, whether pressure or gravity type.

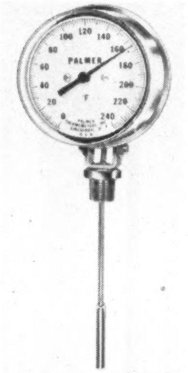


Draft King

Look at all these money-saving features! Draft King turns flue gases into perfect heating combustion, not chimney clogging soot. Maximum draft provides full burning benefit of fuel and eliminates costly fuel waste so common with poor chimney drafts. Made of either all-weather galvanized steel or aluminum.

Show them, talk about them, sell them . . . they're PROFITABLE!

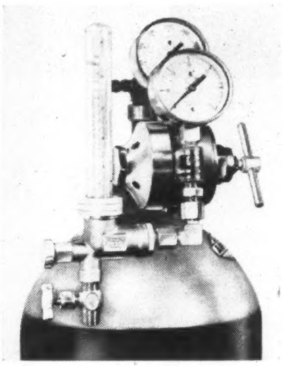
for information write to
NORWOOD PRODUCTS CO. • LUVERNE, MINN.
A division of A. R. WOOD MFG. CO., Luverne, Minn.



3 1/2 in. Dial Thermometer

. . . designed to fit all bimetallic wells —*Palmer Thermometers, Inc., Dept. HPAC,* 2501 *Norwood Ave., Cincinnati* 12.

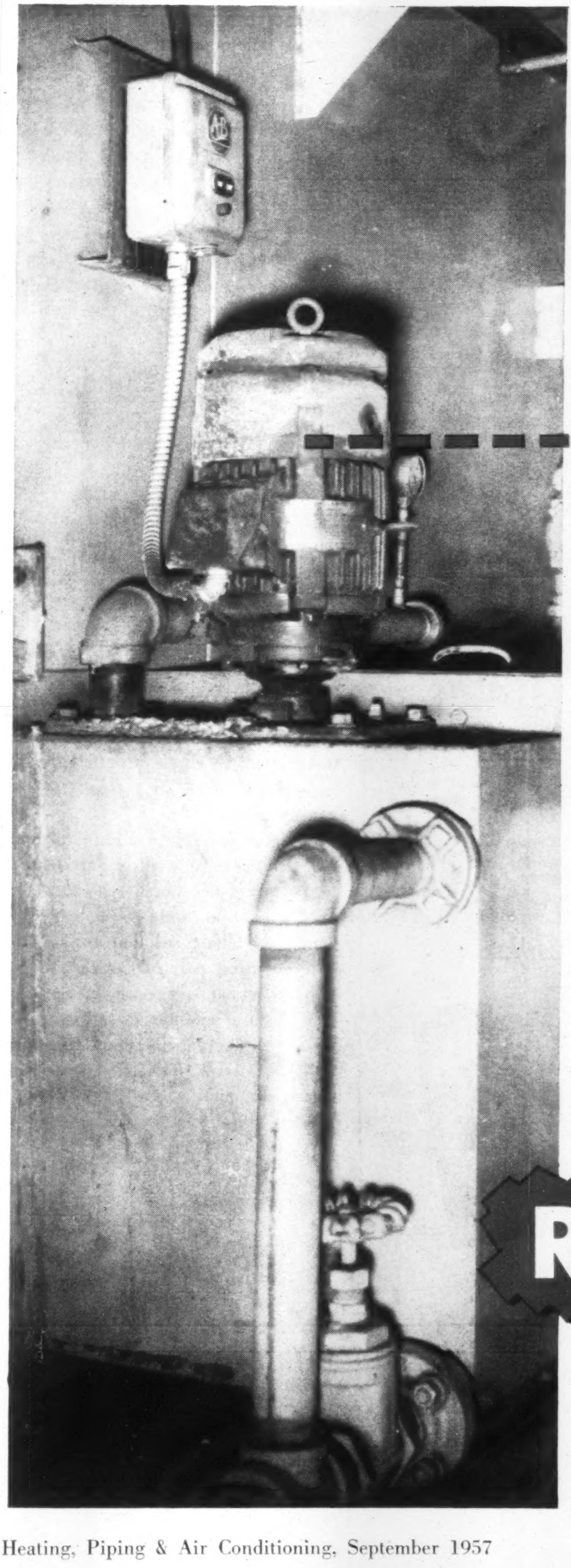
Stem can be placed at any angle and case rotated to any readable position without affected accuracy of instrument, says company. With 1/4 in. diameter bulb, 1/2 in. NPT fitting. Cited features: direct drive bourdon coil, filled system, external calibration for zero setting, no sticking at any temperature, stainless steel case, accuracy to one scale division.



Dual Range Flowmeters . .

. . . for inert gas welding, flushing molten metals, laboratory service, other industrial applications where accurate control and visual check of flow rate are required—*Air Reduction Sales Co., Div. of Air Reduction Co., Inc., Dept. HPAC,* 150 *E.* 42*nd St., New York* 17.

Flow ranges are said to be sufficiently wide to meet gas demands for-



RELIANCE solves motor corrosion problem

This Reliance Corrosion-Proof Motor is operating a pump which circulates cleaning solution through a tank containing metal parts. The motor is subjected to corrosive vapors and liquids each time a basket of parts is removed. BUT THIS MOTOR WILL NOT CORRODE.

The solid cast-iron housing, including the fan cover, will withstand corrosive service indefinitely. Wiring identification is preserved on a stainless steel name plate. A threaded outlet is provided on the water tight conduit box, and motor leads are molded into a neoprene gasket that completely seals off the windings from the conduit box. A neoprene or non-ferrous shaft slinger seals the only other frame opening.

These and many other features give you a motor with a built-in corrosion protection. Why not install this superior design now and save many replacement dollars in the years ahead.

Write for bulletin B-2406 for complete design details.

B-1534

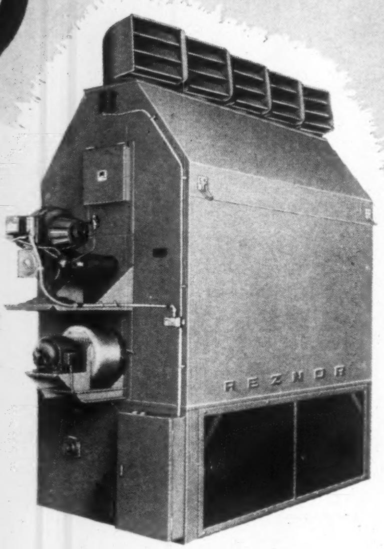
RELIANCE ELECTRIC AND ENGINEERING CO.

Dept. 369A, CLEVELAND 17, OHIO
CANADIAN DIVISION: WELLAND, ONTARIO
Sales Offices and Distributors
in Principal Cities

Here's the answer to your BIG SPACE HEATING PROBLEMS

Reznor-Olson

STAINLESS STEEL
DIRECT FIRED
HEATERS

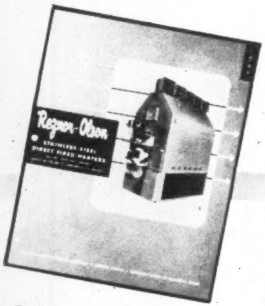


These units are designed for heating factories, warehouses, garages, airplane hangars, gymnasiums and other large open areas. They pick cold air up off the floor, distribute heated air overhead at high velocity—either direct or thru ducts. In addition to space heating installations, Reznor-Olson heaters are well-suited for use in make-up air systems and in drying and other process applications.

Reznor-Olson heaters are available in ten sizes — 400,000 to 2,000,000 Btu — with gas, oil or dual-fuel burners. They may be floor mounted for top discharge or suspended for down-blast or horizontal discharge.

New Bulletin gives Complete Specifications

Complete specification information — including dimensions, control details, temperature rise, air delivery and fuel consumption — is included in a new bulletin, F-57A-RO. If you don't have a copy of this bulletin in your files, just fill out and mail the coupon below. Do it today.

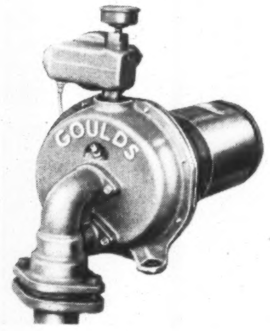


REZNOR
WORLD'S LARGEST-SELLING DIRECT-FIRED
UNIT HEATERS
Reznor Manufacturing Company, 51 Union St., Mercer, Pa.

Please send me a copy of your bulletin F-57A-RO which gives complete specification data and construction details on Reznor-Olson direct fired heaters.

Name____________________
Company____________________
Street____________________
City__________ Zone_____ State________

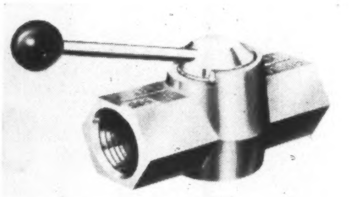
merly requiring more than one metering device. In-service switching from either flow range to the other done by means of piston type selector valve. Flow rate within either range controlled by needle valve. "1600" series includes seven direct reading flowmeters, each for specific gas, and one general purpose flowmeter which will meter any of five gases.



Well Casing Adapter . . .

. . . designed to permit over-the-well installation on single pipe deep wells —*Goulds Pumps, Inc., Dept. HPAC, Seneca Falls, N.Y.*

Adapter is said to eliminate need for special casing seal. Is particularly useful whenever pumps are installed outdoor or in mild climates, says company. Offset installations simplified by using pair of casing adapter flanges which are used to connect well casing adapter to offset pipe screwed into tapped pump openings. Units available for 2, 3 in. inside casing diameter.



Plug Valves . . .

. . . in new sizes for wider application—*Circle Seal Products Co., Inc., Dept. HPAC,* 2181 *E. Foothill Blvd., Pasadena, Calif.*

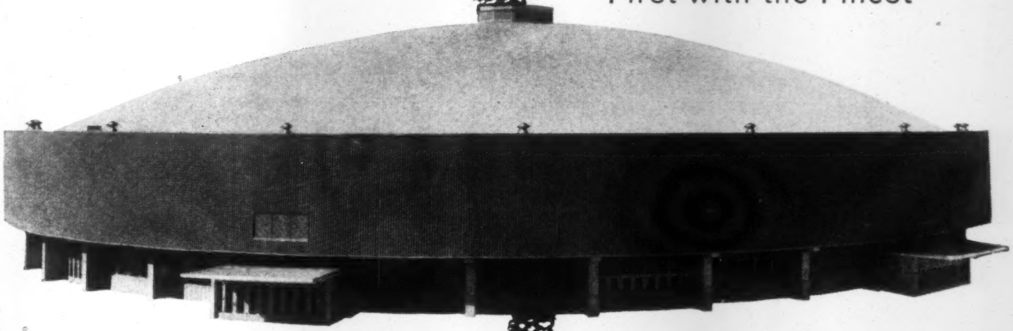
Cited features include tight shut-

10 YEARS AGO . . .

JENN-AIR Revolutionized the Exhauster Industry with Low Contour Spun Aluminum Design

10 YEARS LATER . . .

JENN-AIR is Still First with the Finest



University of Wichita Field House, Wichita, Kansas, where Jenn-Air Exhausters were used.
Architect: Lorenz Schmidt, McVay & Peddie, Wichita; Mechanical Engineer: Oakle P. Bullock, Wichita.

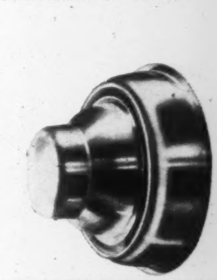
It's been a decade since Jenn-Air charted the course in the power exhauster industry by introducing spun aluminum exhausters with *low contour* design. This year marks the 10th anniversary of low contour spun aluminum roof and wall exhausters. As the creator of low contour design, Jenn-Air naturally leads the field in experience.

Here's how Oakle P. Bullock, consulting engineer, views Jenn-Air's contribution to the industry: "When Jenn-Air introduced this fan on the market it solved a big problem of the Architects and Engineers. Before that time we were using a very unsightly type installation and welcomed Jenn-Air Exhausters."

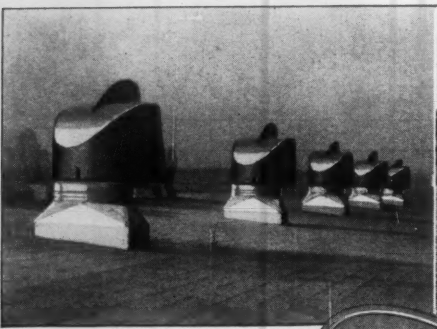
Jenn-Air still is "on the move." Company stability is reinforced with engineering imagination—or "Visioneering"—to preserve Jenn-Air's reputation for always being *First with the Finest.* FIRST with low contour design and spun aluminum construction . . . and now, FIRST with stainless steel U-spring vibration isolators which show 44% less vibration transmission than rubber or neoprene.

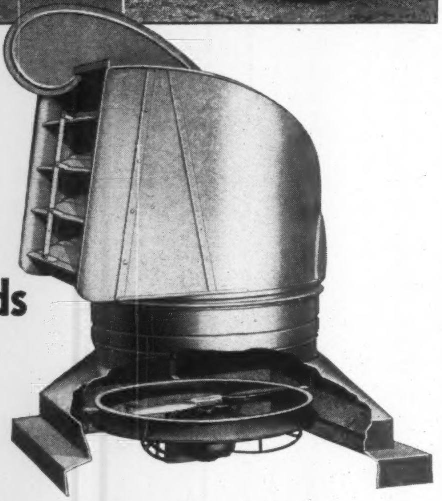
JENN-AIR PRODUCTS COMPANY, INC.
1102 Stadium Drive • Indianapolis 7, Indiana

Jenn-Air Quiet-Tested Roof Exhauster, with U-Spring Cushion Suspension Mounting. Note low contour design.



Jenn-Air Wall Exhauster—architecturally-sculptured button design, spots ventilation control.





How to handle ventilation needs that vary; use the *double duty*

Swartwout *Airjector* Roof Ventilator

Here's the *adaptability* you've wanted in ventilating buildings where you have extra floods of heat or fumes at certain periods. Airjector gives you large capacity *power* expulsion when you need it, but saves power when the capacity requirement is less by acting as a *gravity* type ventilator. Its ball bearing *rotary mounting* increases efficiency at all times by keeping the discharge opening always downwind.

Airjector moves a large volume of air at low cost — combines economy and efficiency with pleasing appearance. Oversize outlet and curved head cut static resistance to a minimum. And any appreciable outside air currents passing around the head provide extra suction effect on the outlet area. Capacities for the 13 sizes, and many capacity variations, carry Certified Ratings under the standard test codes.

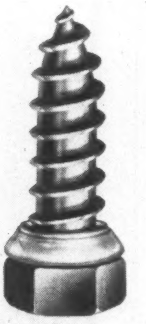
For peak loads — or for ordinary gravity ventilation — you pay only for what you need with this *double duty* method available in the Airjector. It's the answer for ventilation problems in many situations, such as welding shops, spray booths, heat treating rooms, forge shops, over pickling tanks, galvanizing and plating rooms, etc. Write for complete catalog data, Bulletin AJ-F.

THE SWARTWOUT COMPANY
18511 Euclid Avenue Cleveland 12, Ohio
Representatives in all Principal Cities

Swartwout **ROOF VENTILATORS AND VENTILATING LOUVERS**

ALSO AUTRONIC PROCESS CONTROL EQUIPMENT

off through use of o-ring flow seal, o-rings at top and bottom to prevent external leakage. In open position, unit is full ported and allows straight through flow passage. Operated by handles that open, close against pressure. In pipe sizes $1/4$, $1/2$, $3/4$ in. Smallest size available in stainless steel with aluminum handle. Other sizes in brass.



Fastener Seal . . .

. . . designed for quick, secure, economical weatherproof fastening — *Parker-Kalon, Div. of General American Transportation Corp., Dept. HPAC, Clifton, N. J.*

"Nyltite Staps" consists of self forming nylon washer preassembled to standard self tapping screw. Washer compresses against head and threads of fastener as screw is turned in, thus sealing opening against moisture, says company.

Foam . . .

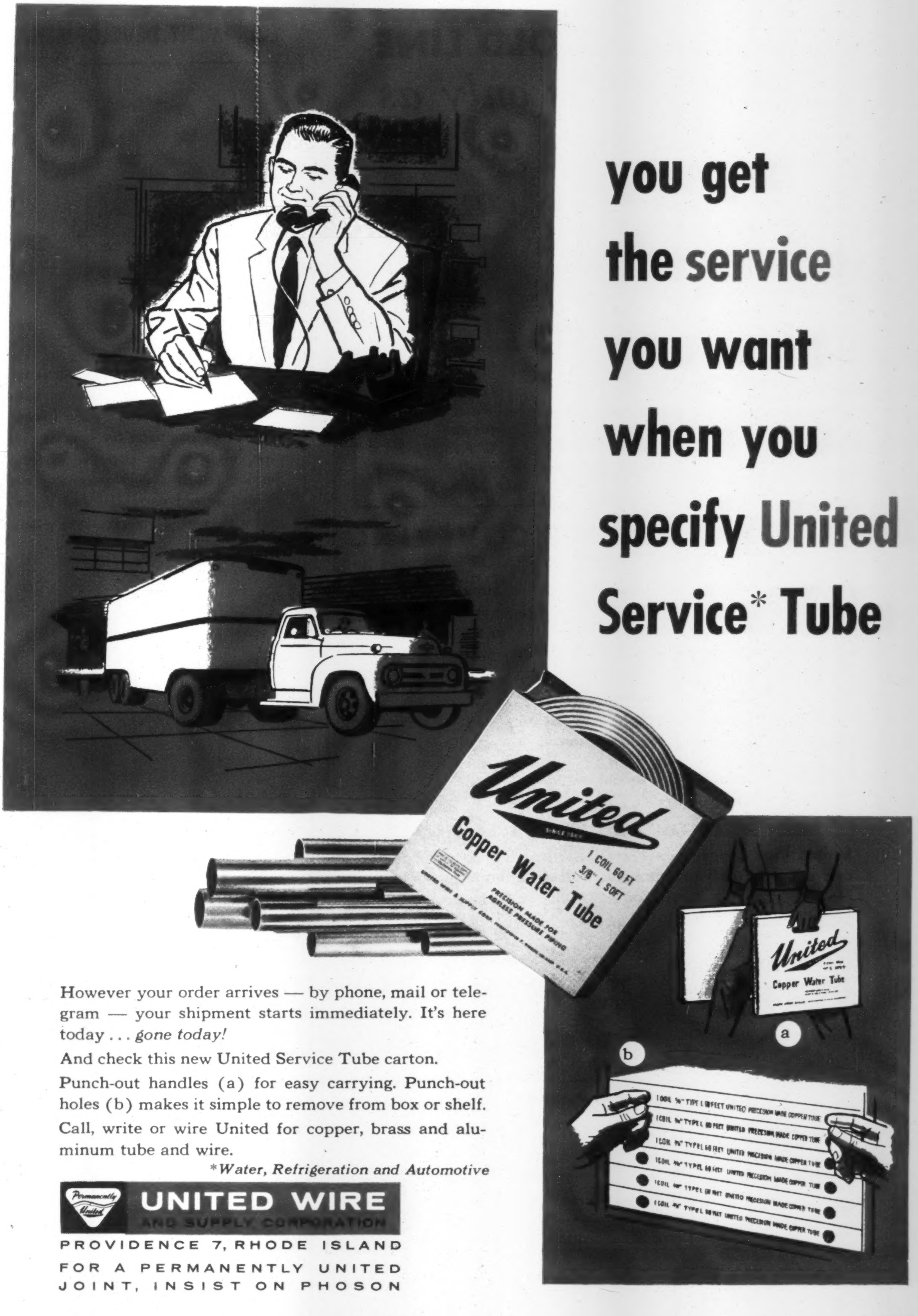
. . . for use as cushioning material, sound and thermal insulator—*General Tire & Rubber Co., Dept. HPAC, 1708 Englewood, Akron, Ohio.*

"Polyfoam" polyether based urethane foam formulated to have high strength, durability. Is said to be lightweight, have high degree of compatibility with other materials.

Oil Burner Fuel Filter . . .

. . . designed for quick, easy servicing without tools—*Wix Corp., Dept. HPAC, Gastonia, N.C.*

Cited features of "spin-on/spin-


United
Copper Water Tube
1 COIL 60 FT
3/8" L SOFT
PRECISION MADE FOR AGELESS PRESSURE PIPING
a
b
United
Copper Water Tube
1 COIL TYPE L 60 FEET UNITED PRECISION MADE COPPER TUBE

you get the service you want when you specify United Service* Tube

However your order arrives — by phone, mail or telegram — your shipment starts immediately. It's here today . . . *gone today!*

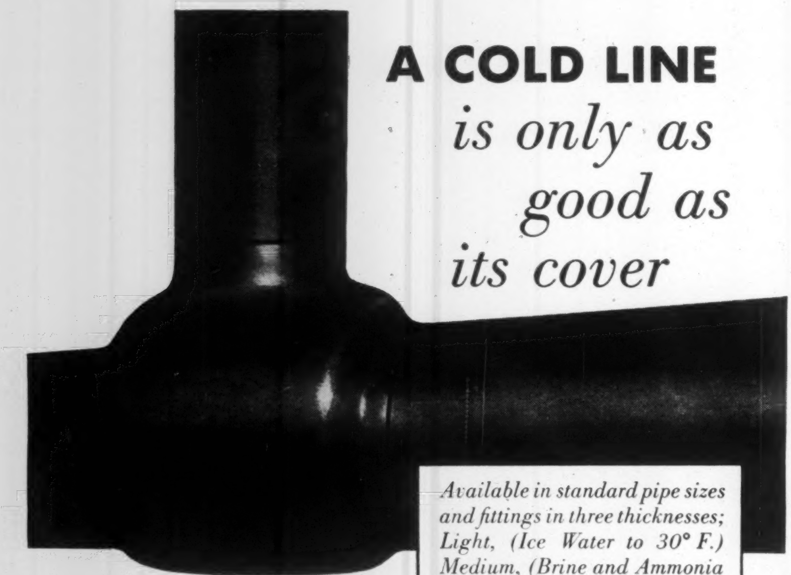
And check this new United Service Tube carton.

Punch-out handles (a) for easy carrying. Punch-out holes (b) makes it simple to remove from box or shelf.

Call, write or wire United for copper, brass and aluminum tube and wire.

**Water, Refrigeration and Automotive*

UNITED WIRE
AND SUPPLY CORPORATION
PROVIDENCE 7, RHODE ISLAND
FOR A PERMANENTLY UNITED JOINT, INSIST ON PHOSON



A COLD LINE *is only as good as its cover*

Available in standard pipe sizes and fittings in three thicknesses; Light, (Ice Water to 30° F.) Medium, (Brine and Ammonia to 0° F.) Heavy, (Heavy Brine—25° F. and lower.)

UNITED CORK PIPE COVERING

THE IDEAL COLD LINE INSULATOR

A cold line system is only as effective as its insulation. Inferior pipe covering in just one section of the line will cause operating costs to skyrocket and a considerable loss in dollars to the cold storage operator. United's pipe covering gives you the best insulation with all these advantages:

Extremely low "K" factor
Retains over 80% of cold loss on piping
Easy and economical to install
Long trouble-free life
Fire retardant—Vermin resistant
No capillarity

LARGER STOCKS—FASTER DELIVERY—PERSONAL SERVICE

United Pipe Coverings are available from stock for prompt delivery—to fulfill your immediate installation requirements. Mail the coupon below for additional information or the name of the United distributor nearest you.

Corkboard Pipe Covering Tank Lagging

UNITED BB CORKBOARD

UNITED CORK COMPANIES
1 Central Ave., Kearny, New Jersey

Manufacturers of cork insulation for almost a half century

UNITED CORK COMPANIES, 1 Central Ave., Kearny, N.J.
Please send United Cork Catalog. I am interested in
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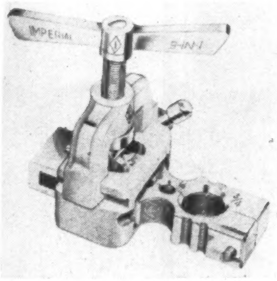
ADDRESS ______________________________
CITY ______________ ZONE ______ STATE ______

Engineering offices, or approved distributors, in key cities—coast to coast.

EQUIPMENT DEVELOPMENTS

Continued

off" filter are convenience, efficiency, safety, economy, plus simple hand installation and removal. Recommended by company for one- or two-pipe, high or low pressure systems. Service requires only removing and discarding old cartridge and replacing with new cartridge, says manufacturer.



Flaring Tool . . .

. . . for making 45 deg flares to SAE standards on 9 sizes of soft copper, aluminum, brass tubing—*Imperial Brass Mfg. Co., Dept. HPAC, 1200 W. Harrison St., Chicago 7.*

Design utilizes rotating die bar to provide for 1/8, 3/16, 1/4, 5/16, 3/8, 7/16, 1/2, 5/8, 3/4 in. OD sizes in minimum space, says company. Bar is 4 1/8 in. long. Tool weighs 1 lb, 13 oz.

PVC Tape . . .

. . . formulated to be waterproof and resist heat, cold, acids, alkalis, corrosives, abrasives—*Devon Tape Corp., Dept. HPAC, 519 S. Fifth Ave., Mt., Vernon, N.Y.*

"No. 12" available transparent or

NEW NEW & NEW EQUAL NEWS

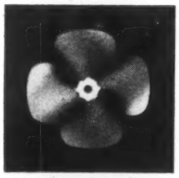
It's the *new* Torrington line of Vari-Basic blower units for central heating and air conditioning equipment, now in production at all three Torrington plants. And here is why this important product development is *news*.

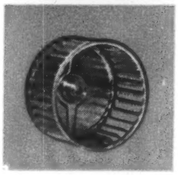
1. New quality: Engineering features include the famous Center-Lock Airotor wheel design . . . permanently plastic lubricated Randall bearings, with 3-point suspension . . . and spot-welded heavy steel construction, superbly finished.

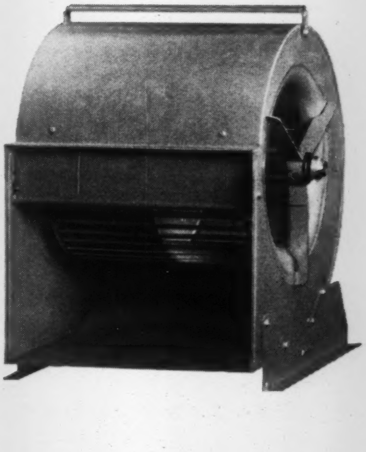
2. New flexibility: The units are designed for interchangeability with existing standard equipment, and Torrington's marketing policy makes these components available singly or in combination.

3. New versatility: These units are available in a wide range of sizes designed to provide maximum variability to meet directional-flow requirements.

Your inquiries are invited. For full information, *talk to Torrington!*







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TORRINGTON, CONNECTICUT · VAN NUYS, CALIFORNIA · OAKVILLE, ONTARIO

...for straight right-angle cuts every time...the new

RIDGID

Wide-Roll Pipe Cutter

fast true pipe cuts on your power drive

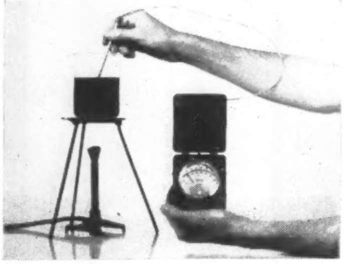
Rolls are twice the usual width, double the bearing surface on pipe—sure straight start of cut . . . by hand or power drive—extra fast and easy. Pays you to see it before you buy your next cutter—at your Supply House.

No. 201, ⅛″ to 1¼″
No. 202, ¼″ to 2″

The Ridge Tool Company, Elyria, Ohio, U.S.A.

RIDGID
Work-Saver Pipe Tools

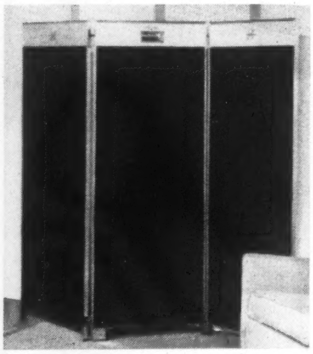
in nine colors. Recommended by company for variety of applications, including pipe line marking. Packed in 1 and 6 in. high bulk tins. In widths ¼ in. and up.



Indicator . . .

. . . designed for making rapid fluid temperature measurements at closely differentiated points in volume of material—*Royco Instruments, Dept. HPAC, 720 Arthur St., Albany, Calif.*

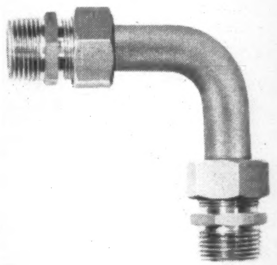
"CTL" combines indicating meter, which is housed in hand-held enclosure having protective cover, with 12 in. stainless steel probe attached to 30 in. length of flexible armored cable. Variations in probe and cable can be supplied for special purposes, says company. Four ranges available: zero to 300 F, zero to 450 F, zero to 650 F, zero to 1000 F. Corresponding centigrade scale provided.



Radiant Heat Screen . . .

. . . designed as new concept of heating for individualized comfort—*Arvin Industries, Inc., Dept. HPAC, Columbus, Ind.*

Heater has form of three-panel screen and has 20 sq ft radiant heating area. Recommended by company for use in doctors' offices, hospitals, rest homes, other institutions, schools, office buildings, hotels, motels. Heat can be focused by turning in "wing" panels, says company. Operates on 110 volts, a-c.



Corner Connectors . . .

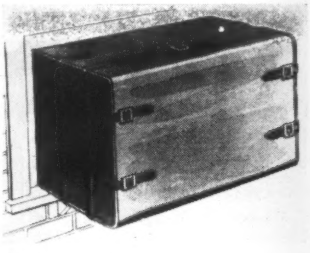
. . . for baseboard radiant heating systems—*General Fittings Co., Dept. HPAC, East Greenwich, R.I.*

Prefabricated fittings available in 45, 90, 180 deg bends. All are 3/4 in. male pipe threads × 3/4 in. OD compression sleeve brass or aluminum unions. Require no sweating, says company.

Variable Speed System . . .

. . . which can be automatically controlled in response to variety of input signals—*U.S. Electrical Motors, Inc., Dept. HPAC, Box 2058, Terminal Annex, Los Angeles 54.*

System combines "Varidyne" power unit and one or more a-c induction motors and "Varitrol" automatic pneumatic control system. Combination is said to make it possible to automatically change speeds of several motors equally, simultaneously.



Air Conditioner Cover . . .

. . . designed to withstand all weather conditions, remain pliable even at −20 F—*Bogene, Inc., Dept. HPAC, 286 Fifth Ave., New York.*

Made of 12 gage specially formulated polyvinyl chloride, says company. Available in four styles.

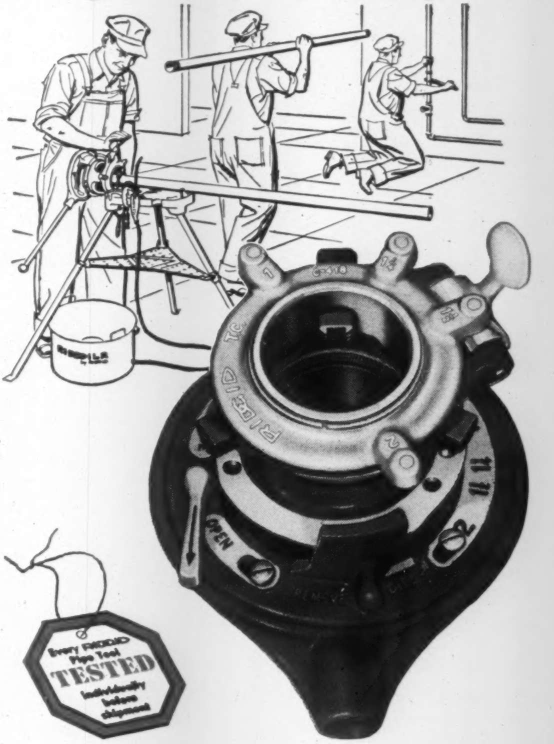
Bondable Teflon . . .

. . . for lining or covering tanks, pipes, ducts, facings for valves, similar applications—*Abbott & Biddle, Dept. HPAC, 2413-27 Federal St., Philadelphia 1.*

Company surface treats sheets, tapes for bonding purposes. Process alters surface of teflon to make possible permanent bonding to variety of materials with conventional adhesives, says manufacturer. ‡

RIDGID

Jam-proof 65R
Now Guarantees
Straight Threads Every Time


Every RIDGID Pipe Tool TESTED individually before shipment
OPEN

. . . Revolutionary New TC (True-Centering) Workholder centers all pipe, even over or under size

No more crooked threads! 65R pre-sets to size by turn of TC Workholder gauge ring—tightens by palm-of-hand push on forged cam lever. All 3 jaws close together on pipe by one mechanical action. Always straight threads, jamproof, 1″ to 2″ with 1 set of dies, fast size change—only 65R offers you so much for your money. Buy it at your Supply House.

P.S. The new TC workholder fits your present 65R!

The Ridge Tool Company • Elyria, Ohio, U.S.A.

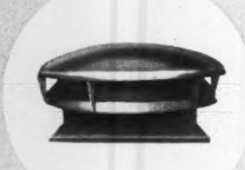
RIDGID
Work-Saver Pipe Tools

ACCEPTED

Allen

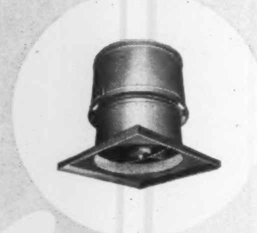
ROOF VENTILATION

Whatever your ventilating needs, be sure to see how Allen equipment can meet your requirements efficiently and economically.



NEW "I-LINE" for EYE APPEAL

The new "I-Line" provides an attractive low contour, assuring maximum capacity or efficiency with the minimum over-all height.



POWERFUL "VD" for HIGH VELOCITY

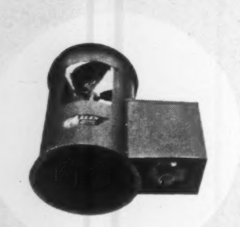
By moving a large volume of air at high velocity, this Vertical Discharge fan keeps fumes from sifting back into building.

Allen

. . . is prepared to investigate ventilating problems and plan systems for the efficient removal of heat, fumes, vapor or dust.

WIND-DRIVEN TURBINES

Three types of Allen turbines take full advantage of the economy of natural air movement.



EXHAUST FANS

Remote drive Staxauster is designed to handle corrosive fumes, and/or high temperature air.

THE ALLEN LINE

Write today for catalog that gives specifications and performance data on these and other units in the Allen ventilator line.

ALLEN
ENGINEERED VENTILATION

ALLEN COOLER & VENTILATOR, INC.
ROCHESTER, MICH.

Roof Ventilators for Every Commercial and Industrial Need
REPRESENTATIVES IN PRINCIPAL CITIES

RECENT TRADE LITERATURE...

▶ *A-C INDUSTRIAL WELDERS*—Publication GEC-1259C, 4 pages, illustrated, includes product features, specifications, power requirements, operating data and list of optional features for a-c welders in 300, 400, 500 amp ratings. *General Electric Co., Dept. HPAC, Schenectady* 5, *N.Y.*

▶ *AIR CONDITIONING, VENTILATION, REFRIGERATION, HEATING*—Air conditioning, ventilation, refrigeration and heating equipment and supplies listed in 1957 estimating catalog. Tables listing items supplied. *M. Blazer and Son, Dept. HPAC,* 173 *Market St., Passaic, N.J.*

▶ *AIR FILTER*—New 4 page booklet describes filter composed of cadmium plated permanent metal frame and disposable pad of synthetic fibers. Filter pad held in place by cadmium plated retainer ring. Literature presents performance data, technical information; cites ease of maintenance. *Air Filter Maintenance Corp., Dept. HPAC,* 542 *W.* 55*th St., New York* 19.

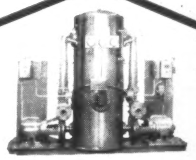
▶ *AUTOMATIC VALVES*—New 12 page catalog gives main uses, installation tips, construction features together with specification tables for automatic valves. Cutaway illustrations included. *A. W. Cash Valve Mfg. Corp., Dept. HPAC,* 666 *E. Wabash Ave., Decatur, Ill.*

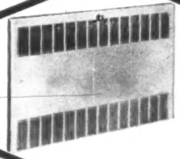
▶ *AUTOMATIC VALVES, CONTROLLERS*—Descriptions, photos of following items given in new catalog: pressure reducing and regulating, relief, back pressure and control valves; controllers; differential regulators; oil pumping units; governors; combination and temperature regulators. *A. W. Cash Co., Dept. HPAC, Box* 551, *Decatur, Ill.*

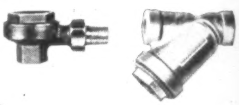
▶ *BASEBOARD RADIATION*—New 4 page catalog describing baseboard line lists various features, gives IBR water ratings, heat and steam capacities and friction loss on the 3/4 in. tube. Features cited: ease of installation, dampers supplied as standard equipment, back panels mount flush at floor line. Illustrations included. *Embassy Steel Products, Inc., Dept. HPAC,* 890 *Stanley Ave., Brooklyn.*

▶ *BOILERS—Solving an Unusual Case of Carryover* is title of technical paper No. 136. Fact that physical condition of boiler is important when steam conductivity goes up is theme of article. *Betz Laboratories, Inc., Dept. HPAC, Gillingham and Worth Sts., Philadelphia* 24.

All Pumps, Convectors and Steam Specialties by DUNHAM-BUSH







ON THIS NATKIN & COMPANY HEATING JOB

CARDINAL GLENNON MEMORIAL HOSPITAL FOR CHILDREN

NATKIN & COMPANY	MAGUOLO & QUICK	HARRY F. WILSON
St. Louis, Missouri	St. Louis, Missouri	St. Louis, Missouri
Heating Contractor	Architect	Consulting Engineer

PUMPS
by Dunham-Bush
VRD65 Duplex Vacuum Pump
VRDA15 Duplex Vacuum Pump
CH2030 Duplex Condensation Pump
CH3030 Duplex Condensation Pump
CH5030 Duplex Condensation Pump

CONVECTORS
by Dunham-Bush
Type 'S' Sloping Top Wall Cabinet Convectors
Type 'R' Recessed Cabinet Convectors
Type 'TOI' Special Panel Convectors

STEAM SPECIALTIES
by Dunham-Bush
'1E' Radiator traps
Float and Thermostatic Traps and Strainers.

Plus Multi-Speed UNIT HEATERS
by Dunham-Bush.

Every day . . . Dunham-Bush "one source—one responsibility" . . . makes more sense to more people who specify and install heating equipment.

At the Cardinal Glennon Memorial Hospital for Children in St. Louis, for example, you'll find *all* pumps, *all* specialties, *all* convectors are by Dunham-Bush.

Let Dunham-Bush assist you in your heating plans. Write for details of our complete heating line.

America Looks to DUNHAM-BUSH *for Modern Heating*

DUNHAM-BUSH, INC.
WEST HARTFORD 10, CONNECTICUT, U. S. A.
SALES OFFICES LOCATED IN PRINCIPAL CITIES

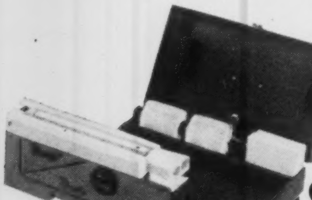
NOW YOU CAN CHECK RELATIVE HUMIDITY ANYWHERE— NO SLINGING OR WHIRLING

This brand-new Bendix-Friez Psychron gives you extremely accurate relative humidity and dew point information with just the flick of a switch. It is a battery-powered portable psychrometer designed and manufactured to meet rigid U. S. Weather Bureau specifications.

Unlike ordinary sling psychrometers, the Bendix* Psychron requires no whirling or special technique to operate. Three standard-size flashlight batteries power a tiny fan that draws air over wet and dry bulb thermometers at a rate exceeding 15 F.P.S. As a result, the Psychron can be safely used in close quarters. It has a special thermal shield to avoid radiation effects for use in bright sunshine and built-in illumination for use in dark or poorly lighted areas.

Order direct from us or through our nearest dealer. For further information write: Bendix-Friez, 1494 Taylor Ave., Baltimore 4, Maryland.

*REG. U.S. PAT. PEND.



$68.50

Price includes metal carrying case, nylon neck strap, psychrometric slide rule, 1-oz. plastic water bottle and instruction book containing humidity and dew point tables.

Friez Instrument
DIVISION

Bendix
AVIATION CORPORATION

RECENT TRADE LITERATURE

Continued

▶ *BRONZE VALVES*—Definitions and comprehensive descriptions of individual items listed in new bronze valve manual. Covers gate valves, globe valves, check valves, boiler drains, radiator and circulator valves, installation and maintenance. *Hammond Brass Works, Dept. HPAC, Hammond, Ind.*

▶ *CENTRIFUGAL PUMPS*—Bulletin No. 3200 describes line of centrifugal pumps designed for use in swimming pool circulation systems, pit drainage, general liquid handling. *Deming Co., Dept. HPAC, Salem, Ohio.*

▶ *CLAY PIPE*—Illustrated 4 page brochure contains information on qualities of vitrified clay pipe with new "Wedge-Lock" plastic joint said to snap together instantly. Literature details mechanics of joint, illustrates installation procedure, describes clay pipe and fittings in diameters 4 to 15 in. *Robinson Clay Product Co., Dept. HPAC, 65 W. State St., Akron 9, Ohio.*

▶ *CLAY PIPE—Big Pipe by Robinson,* 4 page brochure, lists data on large diameter clay pipe, fittings, joints. Sizes, descriptions of standard and extra strength clay pipe with precast slip joint and "Wedge-Lock" joints included. *Robinson Clay Product Co., Dept. HPAC, 65 W. State St., Akron 9, Ohio.*

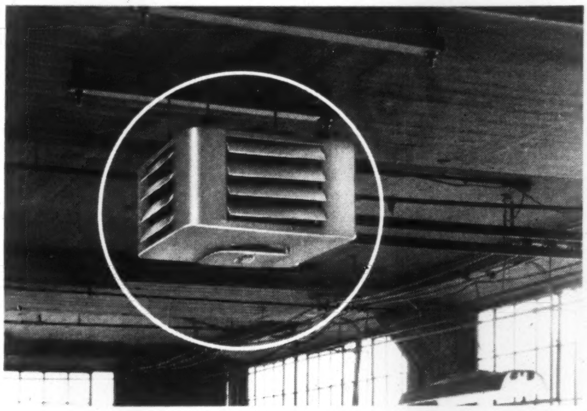
▶ *CLAY PIPE JOINT SEALANT*—Brochure contains photos illustrating installations of vitrified clay pipe using "PT 75" joint sealant. Pictures include underwater installations, "pea soup" and well point trenches, cramped quarter conditions. *Superior Clay Corp., Dept. HPAC, Uhrichsville, Ohio.*

▶ *CONTROL VALVES*—New 4 page booklet has data on types "4030" and "4430" back pressure control

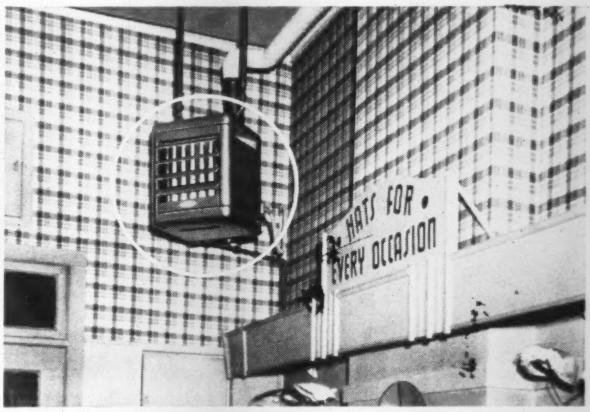
Which is the best way to heat a building?

It depends on the building. The size, the purpose, and the source of heat available can make a big difference. That's why Carrier offers such a wide selection of types and sizes of heaters, and that's why your Carrier agent is the man to work with. Since the Carrier Unit Heater line includes almost every type of commercial or industrial heating equipment, his only interest is to supply you with the type that serves you best in every kind of installation. You'll find him listed in your Classified Telephone Directory under "Heaters—Unit." Carrier Corporation, Syracuse, New York.

FOR SMALL BUILDINGS...

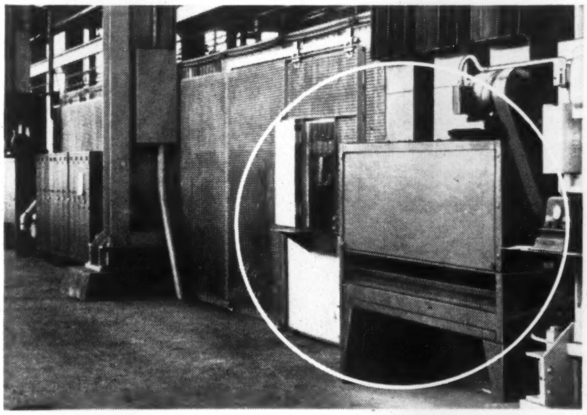


With steam or hot water, choose Carrier 4-Way Unit Heaters. Truly versatile, just one of these exclusive "Clover Leaf" models can do the job of two or more ordinary heaters. Carrier also offers horizontal, vertical and cabinet style unit heaters.

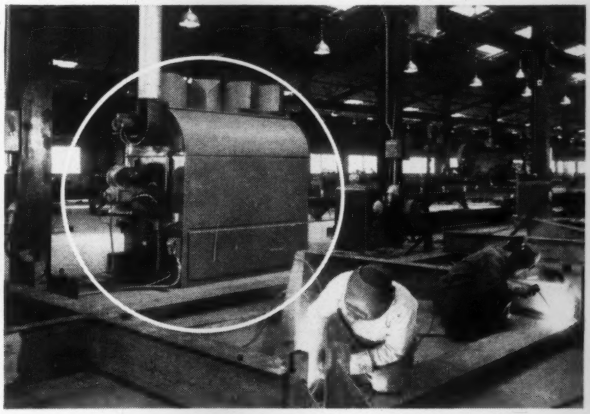


With gas, choose Carrier Gas-fired Unit Heaters or Duct Furnaces... featuring heat exchangers made of aluminized steel for long, dependable service. New large size duct furnaces available for heating in conjunction with air conditioning.

FOR LARGE BUILDINGS...



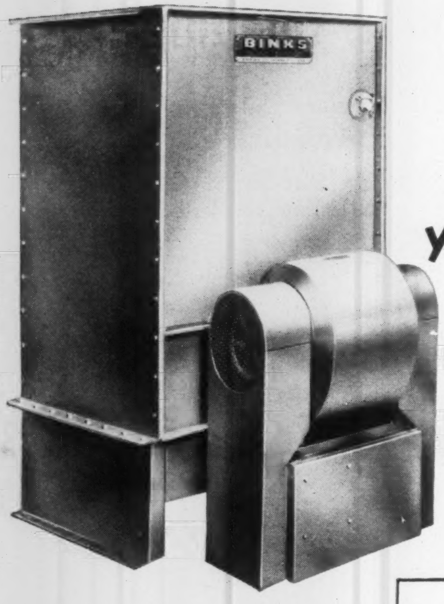
With a central source of heat, choose Carrier Heat Diffusers or Heating and Ventilating Units. Heavy duty blowers, coils, housings and outlets may be individually selected to make up units that perfectly match your heating requirements.



Where there is no boiler, Carrier Heat Diffusers, Direct Fired, offer the most economical method of heating large areas. Completely self-contained, and factory assembled, they need only fuel and power connections to be put in operation.

Carrier

industrial heating
air conditioning
refrigeration



...so QUIET you can install this cooling tower ANYWHERE

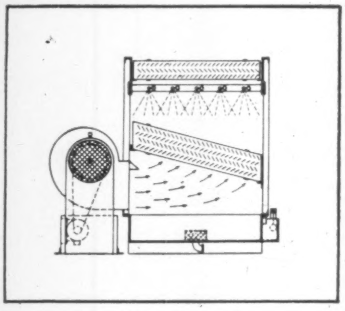
Whisper-quiet Binks 3-B series cooling towers give you complete freedom in establishing their location. Even if conditions dictate that you must place the tower adjacent to hotel or hospital windows, in a residential courtway, or the well of an office building, you can do so with complete confidence that it will disturb no one.

Whisper-quiet operation. Tip speed of the squirrel cage blowers does not exceed 2300 ft. per min. as compared with 7000 ft. per min. or more for propeller fan units of equal capacity. Rugged cast iron blower hubs and dynamic and static balancing also insure vibrationless operation.

Low silhouette. Overall height of largest capacity tower is only 7′6″—it's seldom visible at street level.

High efficiency. Binks patented Roto-jet spray nozzles plus internal redwood nailless decking assure thorough water breakup.

Scientifically balanced air-to-water ratio gives high cooling efficiency under all climatic conditions.



Cross-section showing counter-flow air-water movement employed in Binks 3-B towers.

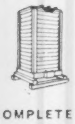
Minimum maintenance. Blowers and motors are outside the tower—not in the moisture laden air stream. All panels are heavily galvanized. Outsides of towers have two coats of aluminum paint. The insides are protected by a durable zinc chromate coating.

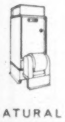
Send for complete data. Ask your Binks Branch Office, or write direct for a copy of Bulletins 477-A and 333. Binks engineers will be glad to answer your questions and help solve your particular cooling problems. There is no obligation.

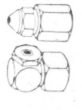
7710

Binks

EVERYTHING FOR WATER COOLING







A COMPLETE LINE OF NATURAL DRAFT AND MECHANICAL DRAFT COOLING TOWERS AND INDUSTRIAL SPRAY NOZZLES

Binks Manufacturing Company
3118-38 Carroll Ave., Chicago 12, Ill.

REPRESENTATIVES IN PRINCIPAL U.S. & CANADIAN CITIES • SEE YOUR CLASSIFIED ☎ DIRECTORY

RECENT TRADE LITERATURE

Continued

valves designed for use in refrigeration systems. Valves said to maintain constant back pressure in evaporator and can be used with air operated temperature controllers to regulate back pressure in evaporator to maintain desired temperature. *A. W. Cash Co., Dept. HPAC, Box* 551, *Decatur, Ill.*

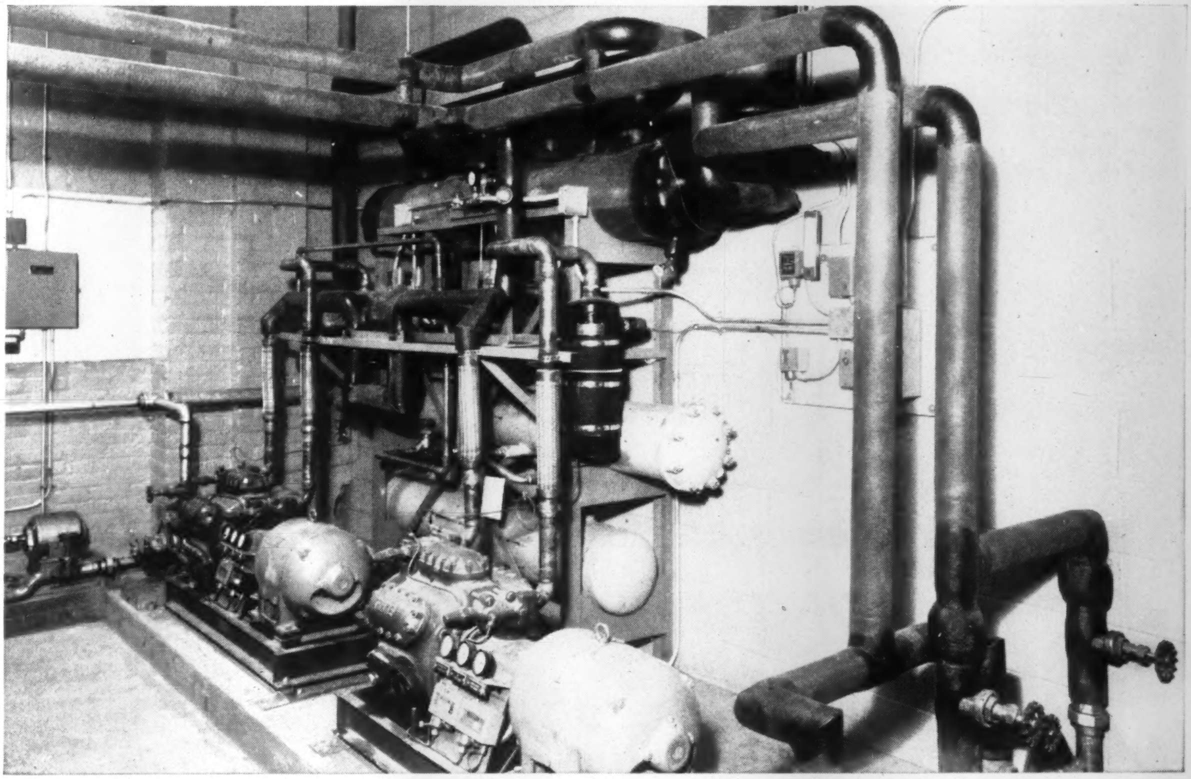
▶ *CONTROLLED VOLUME PUMPS*—Bulletin No. 557 contains specifications, design features, dimensions of "H20" controlled volume pumps. Illustrations included. *Milton Roy Co., Dept. HPAC,* 1300 *E. Mermaid Lane, Philadelphia* 18.

▶ *CORE DRILLING UNIT*—Masonry drilling machine, diamond coring bits are subjects of new 4 page brochure, form D-357. Bits are used in portable equipment to core holes through floors or walls of brick, granite, tile, concrete, aggregate, etc., for conduit or piping. *Diamond Products, Inc., Dept. HPAC,* 402 *Prospect St., Elyria, Ohio.*

▶ *CORROSION PROOFING*—Eight page brochure has tables giving information about corrosion proofing cement mortars, interliners, protective coatings, linings. Data said to be based on studies made in plants involving corrosive atmospheres. *Corrosion Engineering Dept., Pennsalt Chemicals Corp., Dept. HPAC,* 3 *Penn Center, Philadelphia* 2.

▶ *CYCLING, INTERVAL TIMERS*—Information on motor driven cycle timer "Type 571" available in bulletin No. PB-571. Another bulletin, No. PB-271, gives details of motor driven interval timer "Type 271." *Cramer Controls Corp., Dept. HPAC, Centerbrook, Conn.*

▶ *DISC TYPE THERMOSTATS*—*The Story of the Spencer Disc* is title of 32 page booklet. Origin of disc, how it works, how it actuates therm-



Armaflex Pipe Covering and Sheets cut costs of insulating this refrigeration system.

Flexible insulation goes on fast, stops condensation on cold lines

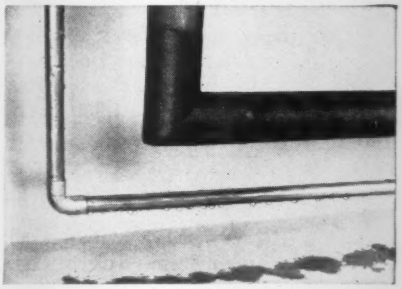
The great flexibility of Armaflex® helps speed the job, often cuts installation time substantially. Armaflex Pipe Covering is slipped over lines or tubing as it is installed, follows contours without any special cutting or fitting. If lines are already in operation, Armaflex is slit lengthwise, snapped in place, and sealed with Armstrong 520 Adhesive. Armaflex sheets on chillers and large diameter piping are applied with 520 Adhesive.

It's easy to stop harmful condensation on cold water and refrigerant lines and equipment, too, with new Armstrong Armaflex. This foamed plastic insulation completely seals out air and moisture, has a remarkably low k-factor of 0.28 at 75° F. mean temperature.

Armaflex is clean to work with. It will not chip, crumble, or rub off, and waste is negligible. It's available in 6′ lengths, $3/8''$ and $1/2''$ wall thicknesses, for pipes and tubing up to $3 1/8''$ o.d., and in 30″ x 36″ sheets, $1/2''$ and $3/8''$ thick. **Send for free booklet** giving complete details on this new insulation. Address Armstrong Cork Company, 2209 Sherman Street, Lancaster, Pennsylvania.

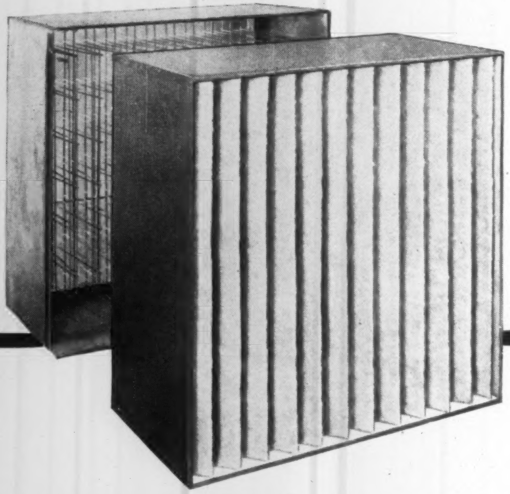
Armstrong INSULATIONS

for temperatures from −300° F. to +2800° F.



Armaflex stops condensation when used within recommended temperatures and humidities. Its cellular composition seals out air and moisture, eliminates need for costly application of a separate vapor barrier.

Rapid insulation of fittings is accomplished by miter-cutting pieces of Armaflex, snapping them into place, and sealing with Armstrong 520 Adhesive. No other sundry is required.



High-Efficiency Air Filtration

is *No Longer* TOO EXPENSIVE

You no longer need accept an inadequate "second best" because of high cost of high-efficiency air-cleaning equipment. Cambridge AEROSOLVE® Filters are available at only a fraction of the cost of other high-efficiency equipment. Now, on all process and comfort conditioning jobs, practical consideration can be given to filters that are effective on the atmospheric dust which they will be required to remove — not just on an artificial (large particle) test dust.

Efficiency Range, 35% to over 90%

(N.B.S. Discoloration Test, Atmospheric Dust)

All AEROSOLVE cartridges fit the same cadmium-plated permanent frames, so that changes in supply-air or process conditions can be met with minimum cost, simply by substituting cartridges of higher or lower efficiency as required.

No water, oil, electric or drain connections are required, and only one building trade is involved in installing AEROSOLVE filters. There is no maintenance beyond infrequent cartridge replacement, which is quickly done by unskilled labor.

These are positive, trouble-free filters with the lowest initial pressure drop, 0.16" to 0.35" wg., of any strainer-type filter of comparable efficiency.

Write for Bulletin 120

Cambridge Filter Corporation

732 E. Erie Blvd., Syracuse 3, N. Y.

Also Makers of the Famous ABSOLUTE® Filter — World's Most Efficient Air Cleaning Device

REPRESENTATIVES IN PRINCIPAL CITIES

RECENT TRADE LITERATURE

Continued

ostats is explained. *Metals and Controls Corp., Spencer Thermostat Div., Dept. HPAC, Attleboro, Mass.*

▶ *EVAPORATIVE CONDENSERS*—Twelve page bulletin features "CM Blow-Through" and "CU Draw-Through" evaporative condensers. Illustrations, charts provided. *Baltimore Aircoil Co., Inc., Dept. HPAC, Box 7322, Baltimore 27.*

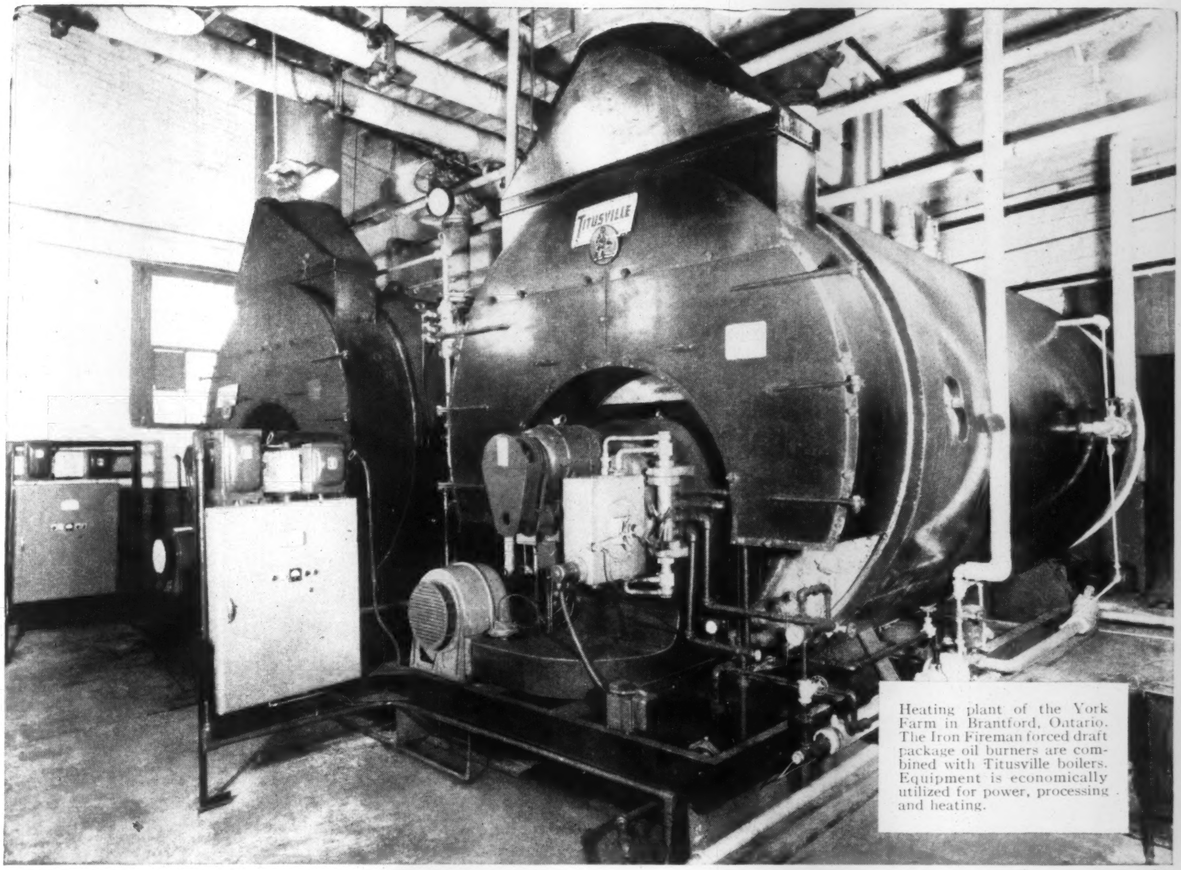
▶ *EXPANSION ANCHORS*—Five types of self-drilling expansion anchors for concrete are described in bulletin No. 57. Details given concerning pin bolt drives which provide grip in brick, concrete, tile, wood, masonry block. *J. D. Polis Mfg. Co., Dept. HPAC, 2900 W. 26th St., Chicago 23.*

▶ *FANS*—Engineering and test facilities for propeller fans, specifications, construction, maintenance and installation listed in 24 page bulletin No. E-57. Tables included. *Aerovent Fan Co., Dept. HPAC, Piqua 29, Ohio.*

▶ *FANS*—Construction, operation, specifications of direct drive and v-belt fans given in 24 page bulletin No. MD-102. Fans are said to be designed for heavy industry, commercial installations, public buildings. *Chicago Blower Corp., Dept. HPAC, 9863 Pacific Ave., Franklin Park, Ill.*

▶ *FANS*—Revised catalog, bulletin A-109C, contains new fan sizes not shown in previous edition. Revised air deliveries, specifications, performance data, dimensional drawings given. *Hartzell Propeller Fan Co., Dept. HPAC, Piqua, Ohio.*

▶ *FUEL OIL TREATMENT*—Sludge disintegration, dispersal in storage tanks and equipment is subject of bulletin FO-157. Treatment which dissolves sludge into combustible



Heating plant of the York Farm in Brantford, Ontario. The Iron Fireman forced draft package oil burners are combined with Titusville boilers. Equipment is economically utilized for power, processing and heating.

These Iron Fireman Package Firing Units Saved the Owner $10,478 in One Year

York Farms in Brantford, Ontario reports that in 1954 fuel costs were $35,650.00. In 1955, after installation of the Iron Fireman forced draft oil burners with matched boilers, the fuel cost was reduced to $25,171.45 . . . a saving of $10,478.55!

Iron Fireman firing system is engineered as a single complete unit. The Iron Fireman "package" burner is a complete combustion system including burner, control panel, forced draft air supply and fuel system, all of which are correctly balanced, integrated, wired and tested at the factory. With Iron Fireman there is no divided responsibility—no locally assembled job with separate estimates and contracts. Rather it means a factory engineered unit which assures dependable performance, high operating efficiency and low fuel cost.

Fits all types of boilers. Firing units can be applied to any type of boiler with great advantages in installation costs and operating efficiency. Installation requires little more than bolting the entire unit to the boiler front and making service connections for power and fuel.

For gas or oil, or gas-oil combination. Takes any type of high or low pressure gas, or any grade of oil from No. 2 to No. 6. Oil-gas models can be switched from one fuel to another at a moment's notice without loss of firing efficiency. For full information, please mail the coupon below.

IRON FIREMAN®

AUTOMATIC FIRING EQUIPMENT
FOR OIL • GAS • COAL

IRON FIREMAN MANUFACTURING COMPANY
3368 West 106th Street, Cleveland 11, Ohio
In Canada: Write 80 Ward Street, Toronto, Ontario

Please send complete technical description and specifications.

Name..

Company..

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City..Zone..........State..........

SOUNDZORBER®

How to stop noise, vibration and "hammer" in water lines

The original SoundZorber expressly designed for use in air conditioning water lines . . .

A wire-reinforced wrapped fabric rubber pipe, SOUNDZORBER can be used continuously in water lines at up to 250 psi working pressure (safety factor: 5 to 1).

Smaller sizes ½" to 3" available with male I.P.T. bronze fittings. Larger sizes available with integral full-faced rubber flanges backed up with Series 15 or Series 30 steel flanges. No metal-to-metal contact.

SOUNDZORBER is but one of a complete line of Finn vibration controls. Finn has control devices for every vibration problem in your field. Write for complete information.

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VIBRATION FINNFLEX CONTROL

T. R. FINN & Company, Inc.
200 Central Ave., Hawthorne, N. J.

® Reg. U. S. Patent Off.

RECENT TRADE LITERATURE

Continued

material and emulsifies condensate water is described. *North American Mogul Products Co., Dept. HPAC, Standard Bldg., Cleveland 13.*

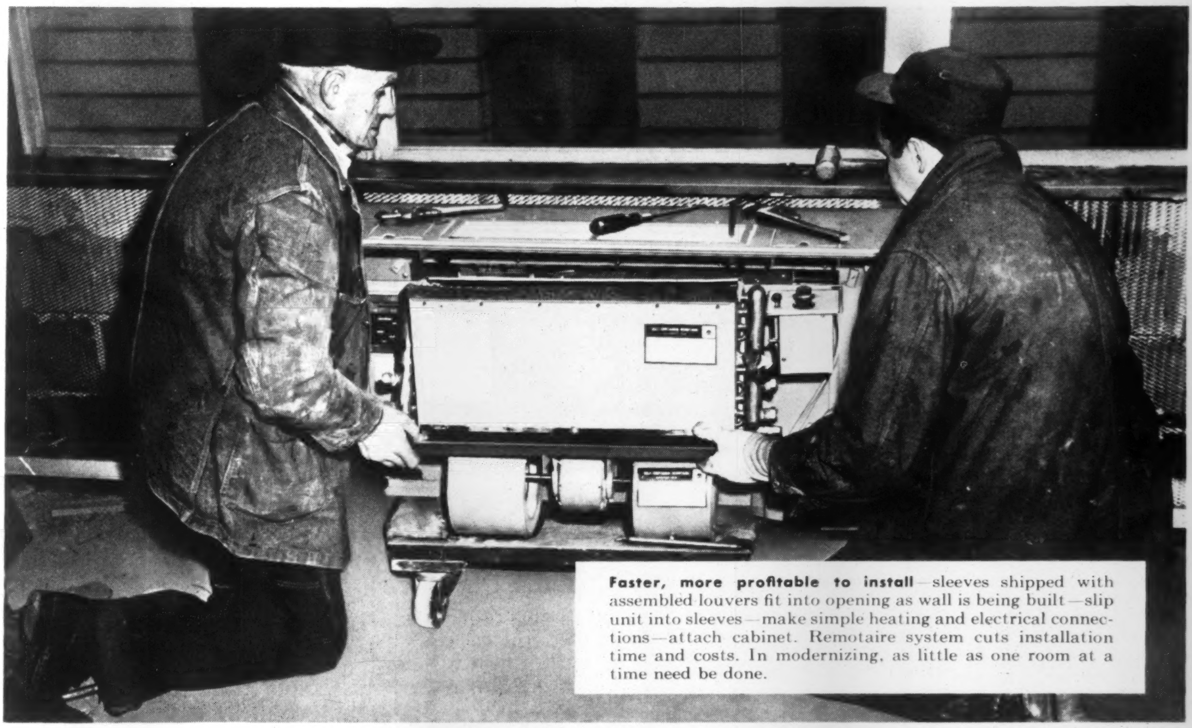
▶ *GAS HEATING BOILERS*—Four page bulletin has capacity, dimension charts for nine sizes of gas heating boilers. Units designed to operate with natural, manufactured, mixed gases. *Portmar Boiler Co., Inc., Dept. HPAC, 193 Seventh St., Brooklyn.*

▶ *GAS THERMOSTAT*—Details of heavy duty, high capacity gas thermostat model "DG" supplied in bulletin No. RT-813. Capacity in ¾ in. size is 145,000 Btu for manufactured gas, 215,500 for natural gas and 455,800 for LP gas. Also, 6 diagrams and drawings included. *Robertshaw-Fulton Controls Co., Dept. HPAC, 110 E. Otterman St., Greensburg, Pa.*

▶ *HIGH PRESSURE EQUIPMENT*—New 125 page catalog, No. 407, lists standard and accessory high pressure equipment designed for pressures to 100,000 psi, temperatures to 1000 F. Contains information on reaction vessels, valves, tubing and fittings; hydraulic and gas booster pumps, compressors, etc. *American Instrument Co., Dept. HPAC, 8030 Georgia Ave., Silver Spring, Md.*

▶ *HOSE CLAMPS*—Booklet describes hose clamps for industrial applications. Details given for worm drive, swivel action, adjustable strap types. *Ideal Corp., Dept. HPAC, 425 Liberty Ave., Brooklyn 7.*

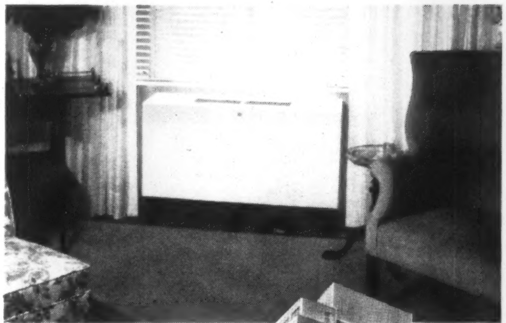
▶ *INDICATING SILICA GEL PRODUCTS*—Comparative data on indicating silica gel products, used to show changes in relative humidity by changes in color, contained in new literature. Company's new "Indicating Gel 327" highlighted. *Davison Chemical Co., Div. of W. R.*



Faster, more profitable to install—sleeves shipped with assembled louvers fit into opening as wall is being built—slip unit into sleeves—make simple heating and electrical connections—attach cabinet. Remotaire system cuts installation time and costs. In modernizing, as little as one room at a time need be done.

WIN MORE BIDS . . .

with flexible, new year-round air conditioning system by AMERICAN-Standard



357 smart Remotaire units were installed in New York's new apartment building . . .

136 E. 55th St.
Builder: Samuel Rudin
Arch: Emery Roth & Sons
Consult. Eng: R. L. Stinard
Mech. Contr: Raisler Corp.

The new American-Standard self-contained Remotaire system is so fast, easy and economical to install that it opens a wider area of air conditioning jobs that you can successfully handle with greater profits—modernization or new construction.

Hotels, motels, office and apartment buildings are lucrative markets for this dependable, space-saving year-round system. Individual temperature control permits occupants to dial their own weather in each room. Trim, compact units take up little room—have self-contained cooling circuits which eliminate costly need of space-consuming central system and unattractive ducts. Gives owner more rentable floor space with no unsightly overhangs to mar the exterior of buildings. Whisper-hushed operation assures restful quiet. And yearly storage costs are saved because units are up to stay.

For more information about this new profit maker—call your local distributor, or write: AMERICAN-STANDARD, PLUMBING & HEATING DIVISION, 40 W. 40th St., New York 18, N. Y.

AMERICAN-Standard

PLUMBING AND HEATING DIVISION

AMERICAN-Standard PRODUCTS

Only **CANTON STOKER**
OFFERS THIS ONE-SOURCE
PACKAGE FOR AUTOMATIC
COAL HEAT

STOKERS TO FIT THE JOB

Canton Stokers are engineered to job specifications at the factory to serve wide ranges of commercial, institutional, industrial and marine requirements. Capacities range up to 3500 pounds of coal per hour for maintaining loads up to 800 H. P.

CLEAN FUEL HANDLING

Canton Flo-Tube Screw Conveyors move coal to Stokers from bins or piles . . . automatically . . . cleanly . . . dependably . . . economically. They move coal without dust and waste spillage.

BALANCED COMBUSTION

Canton "Synchro" Combustion Controls automatically adjust fuel feed, air supply, boiler draft and combustion rates to steam demand, or to water and weather temperatures.

SMOKE CONTROL

Canton "Turbo-Aire" Systems burn smoke where the smoke begins . . . in the furnace. They enable users to comply with smoke abatement regulations.

For lowest possible fuel and maintenance costs, use this exclusive 4-way Canton Stoker package for making coal firing smoke free and up to 90% automatic. One source . . . one responsibility . . . one guarantee. Mail the coupon today.

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CANTON STOKER CORPORATION
707 Andrew Place, S W.
Canton 1, Ohio

50 YEARS OF PROGRESS

N-526-CS

Canton Stoker Corporation
2400 Andrew Place, S. W. • Canton 1, Ohio
Please send complete details about your exclusive 4-way system for making coal firing automatic.

Firm ______
Individual ______ Title ______
Street ______
City ______ Zone ___ State ______

. . . **DEALER FRANCHISES AVAILABLE** . . .

RECENT TRADE LITERATURE

Continued

Grace and Co., Dept. HPAC, Baltimore 3.

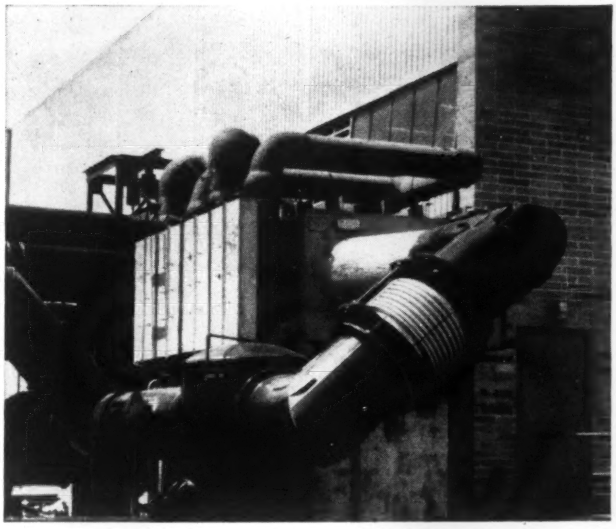
▶ *INSULATED PIPE SYSTEM*—"Temp-Loc" prefabricated insulated pipe system described in 4 page bulletin. Cited feature is that temperature is locked in and moisture is locked out. *Temploc, Inc., Dept. HPAC, 4249 N. Elton Ave., Baldwin Park, Calif.*

▶ *MOTOR STARTERS, CONTACTORS*—New 12 page bulletin describes "Type 425" motor starters, contactors in three sizes 50 to 400 hp. Equipment is said to apply to all types of drives including pumps, blowers, fans, screens, furnace controls. *Allis-Chalmers Mfg. Co., Dept. HPAC, Milwaukee 1.*

▶ *PACKAGED PIPE FITTINGS*—Data on new packaging concept for forged steel pipe fittings presented in 4 page bulletin No. PF-1-57. Quantities of type and size of each fitting packaged in various sizes of cartons, dimensions of each carton and weights of packaged quantities listed. *W-S Fittings Div., H. K. Porter Co., Inc., Dept. HPAC, Box 95, Roselle, N. J.*

▶ *PAINT SPRAY BOOTHS*—New bulletin describes "Mu Hi Wash" paint spray booths. Explains baffles said to control water flow, maintain maximum velocity through spray booth and wash small paint particles with unpolluted water from exhausted air stream. *Ramco Equipment Corp., Dept. HPAC, 1373 Lafayette Ave., New York 59.*

▶ *PIPE COVERING*—Sizes, prices, comprehensive guide in ordering listed in new brochure for anti-sweat, light, standard and heavy duty wall thicknesses "Polyfoam" pipe covering. Fitting covers, vessel-tank insulation also described. Special list



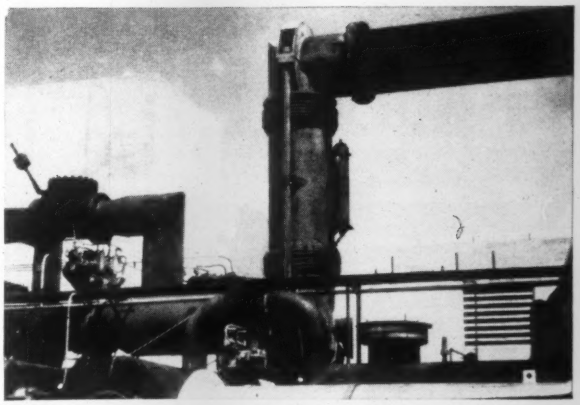
SPECIAL EXPANSION JOINTS

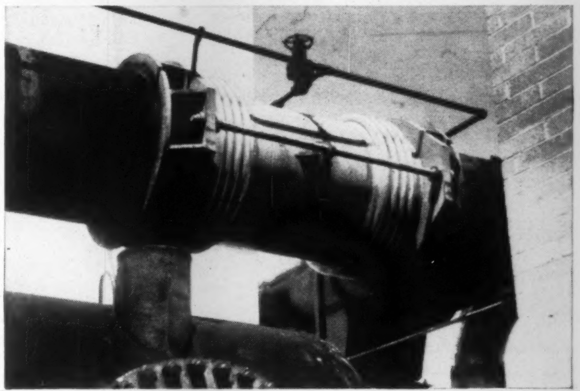
are Second Nature to ADSCO

These photographs show installations of special ADSCO Corruflex Expansion Joints at the Fairchild Engine Division, Fairchild Engine & Airplane Corp., Deer Park, Long Island, N. Y. All joints are designed to absorb lateral motion only, except that the long universal joint, right center, also absorbs any axial growth of its own. All joints are equipped with internal sleeves to smooth out the flow of high-temperature air being carried by the piping systems. They are not standard joints; they are specially engineered, specially manufactured.

A few years ago, when ADSCO was pioneering packless joints for special work, a job like this took considerable engineering and manufacturing time... because it was a new field. But since then, ADSCO has acquired so much experience from so many special orders that special jobs like the Fairchild one are truly "second nature".

Special applications of packless joints are developed carefully but not laboriously. Experience enables ADSCO engineers to get the work out easily and with confidence. Consult them next time you have a special piping problem.





REMEMBER!

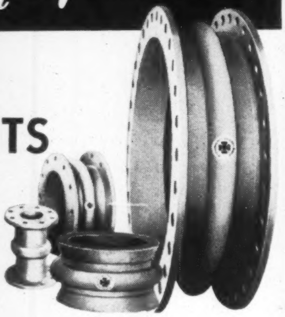
Use ADSCO Expansion Joints instead of Pipe Bends because of these advantages.

1. LESS HEAT LOSS	3. LESS SPACE
2. LESS PRESSURE DROP	4. LESS COST

ADSCO DIVISION
YUBA CONSOLIDATED INDUSTRIES, INC.
20 MILBURN ST. BUFFALO 12, N. Y.

The Economical Answer to
RELIABLE PROTECTION
for Piping and Equipment

GOODALL *Rubber* EXPANSION JOINTS



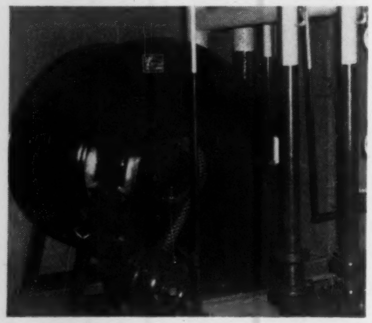
Custom-built to meet specific requirements in sizes from 3/8" I.D. to 96" I.D., for pressures up to 125 lbs. P.S.I. and/or vacuum. They are available in Right Angle and Sleeve Types, as well as "Flang-Lok"; single or multiple arch; tapered; offset; and rectangular.

LONGER SERVICE LIFE. No deterioration through embrittlement or corrosion.

SENSITIVE RESPONSE TO PRESSURE. Only slightest pressure required to create movement in the joint, in any direction. Stress on metal pipe or other connected member reduced to absolute minimum.

EASIER TO INSTALL. Light in weight . . . short face-to-face dimensions . . . retaining rings or flanges quickly aligned and bolted. No gaskets required.

"FLANG-LOK". A patented Goodall development which provides exceptional ease of installation; greater sealing face area; and a completely non-metallic seal.



"*Rubberhide*"
CORROSION-RESISTANT LININGS

If you have a corrosion problem, you can rely on Goodall engineering experience and technical skill for "RUBBERHIDE" Linings compounded to assure long-lasting protection against the particular corrosive agents involved. They will repay many times their cost through extended life of products, parts or equipment.

Produced with either rubber or neoprene as the base material. Processed to objects shipped to our Linings Plants in Trenton, Chicago or Houston; or, when the objects are too large for such shipment, or the work involves fixed plant equipment, experienced field crews do the processing "on location".

* * *

Send for Illustrated Booklet, or Contact Our Nearest Branch

"If it's GOODALL, it MUST be Good!"

Standard of Quality—Since 1870
HOSE · BELTING · FOOTWEAR · CLOTHING AND OTHER INDUSTRIAL RUBBER PRODUCTS

GOODALL *Rubber Company*
GENERAL OFFICES, MILLS and EXPORT DIVISION, TRENTON, N. J.
BRANCHES AND DISTRIBUTORS THROUGHOUT THE UNITED STATES.
IN CANADA: GOODALL RUBBER CO. OF CANADA LTD., TORONTO.

RECENT TRADE LITERATURE

Continued

gives sizes for covering designed to combat condensation problems. *Glo-Bright Products, Inc., Dept. HPAC, 6415 N. California Ave., Chicago 45.*

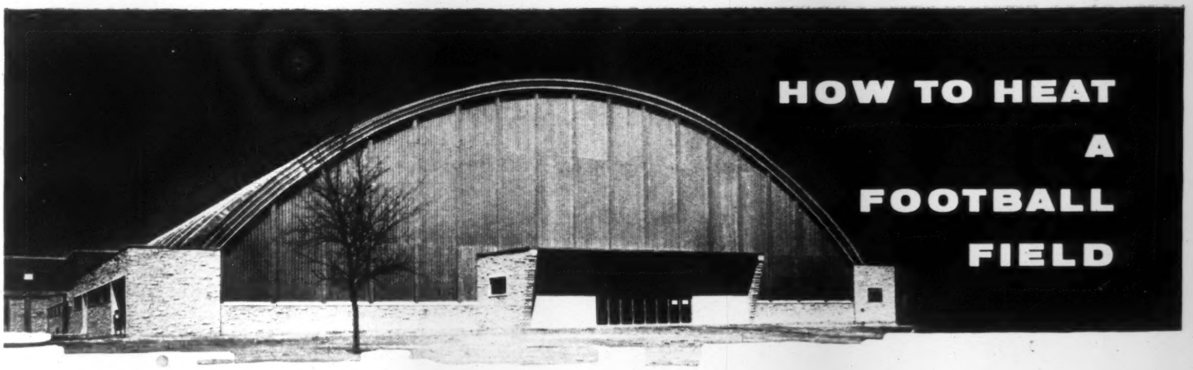
▶ *PIPE FITTINGS, FLANGES*—Literature on unplasticized polyvinyl chloride pipe given in new booklet which lists specifications for threaded and socket types of fittings, valves, flanges made of both normal and high impact material. Charts, tables, formulas included. *Tube Turns Plastics, Inc., Dept. HPAC, 2929 Magazine St., Louisville 11.*

▶ *PLASTIC FOAM INSULATION*—New catalog lists data about "Dyfoam" plastic foam insulation for cold storage warehouses, general building construction. Cited features are fewer joints, low *K* factor, lighter weight, moisture resistance, larger sizes. Charts, diagrams included. *Dyfoam Corp., Dept. HPAC, New Castle, Pa.*

▶ *PLUG VALVE LUBRICANTS*—New 16 page catalog gives lubricant recommendations for nearly 4000 service conditions for which lubricated plug valves can be used. Valve accessories, fittings, automatic lubricators, lubricant guns shown. *Homestead Valve Mfg. Co., Dept. HPAC, Coraopolis, Pa.*

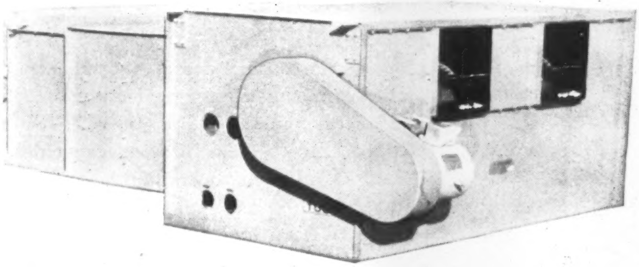
▶ *PRESS BRAKE*—Bulletin No. 90 introduces press brake with electropneumatic friction clutch, power brake and power treadle. Brake houses entire drive inboard, says company. *Niagara Machine and Tool Works, Dept. HPAC, 683 Northland Ave., Buffalo 11, N.Y.*

▶ *PRESSURE DEHUMIDIFIERS*—Information on standard "Desomatic Driline" pressure dehumidifiers for moisture removal from air or gases under pressure available in bulletin R-11B. *Desomatic Products, Dept. HPAC, 1109 W. Broad St., Falls Church, Va.*



HOW TO HEAT A FOOTBALL FIELD

UNIVERSITY BUILDING HOUSES FULL-SIZE FOOTBALL FIELD PLUS TRACK PERIMETER AND BASEBALL DIAMOND

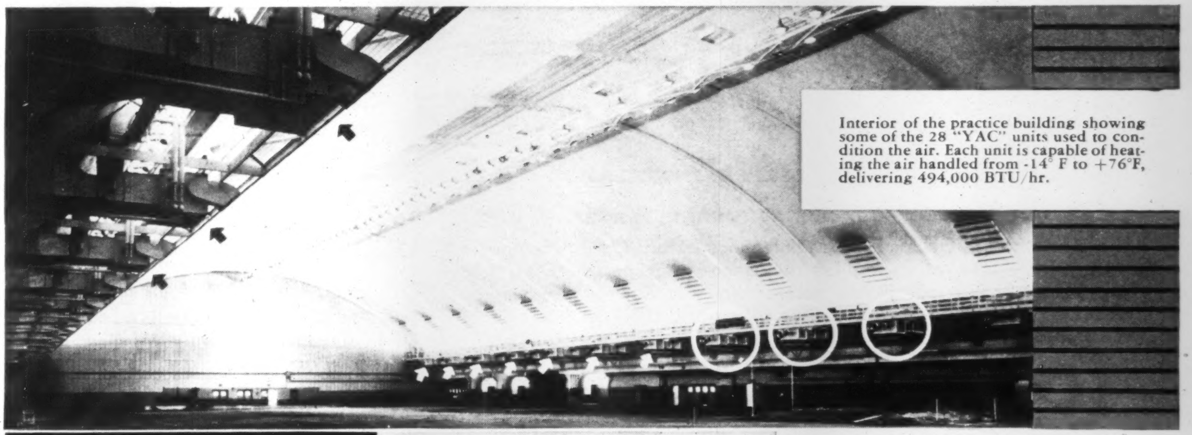


Architect: Scott, Kloppenburg & Scott, Milwaukee
Engineer: Ammann & Whitney, New York
Gen. Cont.: J. L. Simmons Co., Chicago
Mech. Cont.: C. A. Hooper Co., Madison

Young does it with 28 "YAC" UNITS

At a leading Midwestern university, the practice building employs Young "YAC" units for heating and ventilation.

Easy to select, easy to install, simple to service and quiet in operation, Young "YAC" units are available in nine sizes and in horizontal and vertical types. They may be used to furnish any combination of heating, cooling, dehumidifying, ventilation and filtering.



Interior of the practice building showing some of the 28 "YAC" units used to condition the air. Each unit is capable of heating the air handled from -14° F to +76°F, delivering 494,000 BTU/hr.

Young RADIATOR COMPANY

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Creative HEAT TRANSFER ENGINEERS

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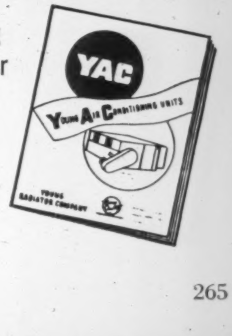

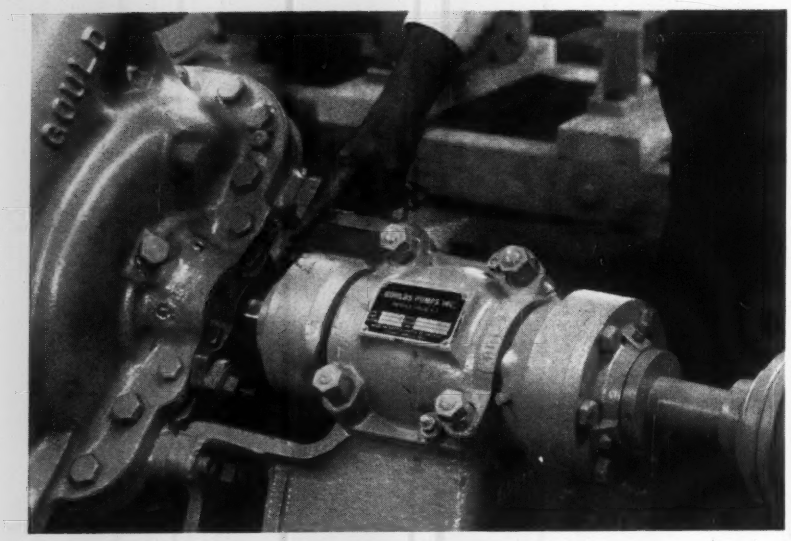

Pump maintenance more important than ever.

Today good pumps are made of materials suited to their jobs. Many, with fluid ends of new, longer-lived alloys, are built to resist corrosion and abrasion longer—much longer. They probably represent more investment per pump. But they'll pay off. All they need is better mechanical attention to match their longer life.

Good way to keep your pumps running longer.

Use a set of these Goulds Pump Maintenance Record Cards. They make it easy for you to set up regular lubrication-inspection schedules; help you plan pump repairs during normal plant shutdowns; give you an accurate "history" on each pump, as a guide to the best materials of construction for your pumping conditions.

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HOUSTON, 2314 Main Street
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Bessemer Bldg., 104—6th Street
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West Coast Representative: GOULDS PUMPS Western, Inc., 1919 N.W. Thurman St., Portland 9, Oregon
In Canada: The A. R. Williams Machinery Co., Ltd.... in all principal cities

RECENT TRADE LITERATURE

Continued

▶ *PROTECTIVE CLOSURES*—Specifications given in new 4 page booklet for both rubber and plastic closures for protection, sealing, masking of threaded parts, pipe ends and tubing. *Shurclose Seal Co., Dept. HPAC, 3000 E. Grand Blvd., Detroit 2.*

▶ *PUMPS*—Four page bulletin describes horizontal, double acting, single cylinder steam pumps. Includes general description, illustrations, capacity tables, parts list. *M.T. Davidson Co., Dept. HPAC, 7 Dey St., New York 7.*

▶ *REFINERY PROCESS PUMPS*—New booklet describes component interchangeability as feature of refinery process pumps, types "PR" and "PRS." Units provide capacities to 1200 gpm, operating heads to 700 ft. *Peerless Pump Div., Food Machinery and Chemical Corp., Dept. HPAC, 301 W. Ave. 26, Los Angeles 31.*

▶ *REGENERATION OF DEIONIZERS*—Literature details "Counterflow" method of ion exchange said to produce better quality effluent. Drawings compare method with conventional process. *Illinois Water Treatment Co., Dept. HPAC, 840 Cedar St., Rockford, Ill.*

▶ *ROTAMETER*—New rotameter, called "Sho-Rate," with 150 mm scale is described in bulletin No. 121. Specification, capacity, dimension data listed. *Brooks Rotameter Co., Dept. HPAC, Lansdale, Pa.*

▶ *SEALANTS*—New catalog gives information on sealants, other chemicals. Has sections on special purpose sealing compounds, general purpose sealing compounds, cements, oils and lubricants, hydraulic fluids, service products, polishes and cleaners. *Permatex, Dept. HPAC, 300 Broadway, Huntington Station, N.Y.*

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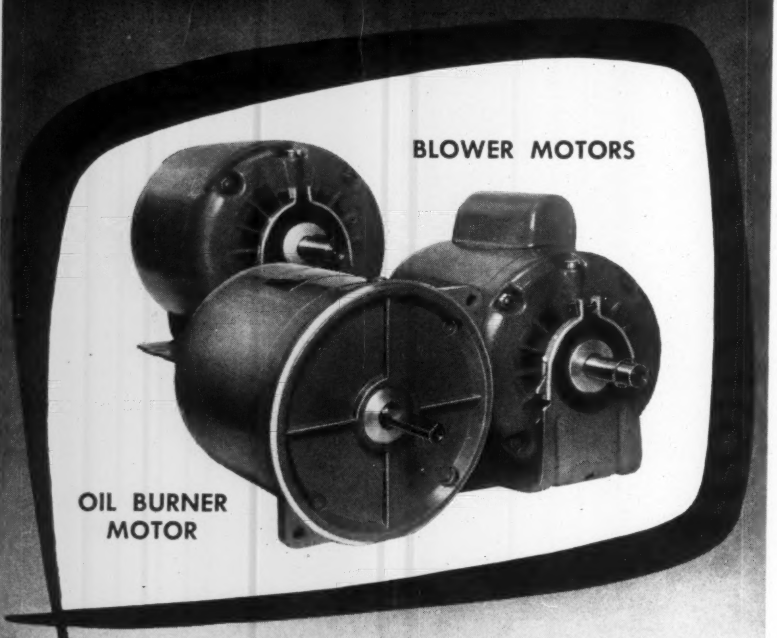
MOTORS



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SALES OFFICES IN PRINCIPAL CITIES

RECENT TRADE LITERATURE

Continued

▶ *SERVICE TOOLS*—Service tools and equipment for "Frigidaire" refrigeration and air conditioning products described, illustrated in new 24 page catalog. *Robinair Div., Kent-Moore Organization, Inc., Dept. HPAC, Warren, Mich.*

▶ *STEAM PUMPS*—Pumps designed for power source, capacity, pressure, viscosity and resistance to abrasive and corrosive actions listed in bulletin WS-18. Feature cited is standard selfsealing pumcup packing. Literature illustrates models, has sizes and sectional drawings. *Wagener Pump Div., Canton Stoker Corp., Dept. HPAC, 300 Andrew Pl., S. W., Canton 1, Ohio.*

▶ *THERMOMETERS*—Two bulletins, Nos. MIT-57 and AAD-57, describe "midget" industrial and "adjust-angle" dial thermometers, respectively. *Weksler Thermometer Corp., Dept. HPAC, 195 E. Merrick Rd., Freeport, L.I., N.Y.*

▶ *TOOLS*—New 120 page general catalog lists 4980 tools for industrial uses, including 500 new types, sizes. Included are wrenches, socket wrenches, drop forged clamps, tool holders, setup and holddown tools, cutting tools, pipe tools. *Armstrong Bros. Tool Co., Dept. HPAC, 5200 W. Armstrong Ave., Chicago 30.*

▶ *TUBING—ALLOY* — Publication ASL 288 presents technical data on "Croloy 18-8 Ti" (AIS type 321). Product designed for long time service at elevated temperatures. *Tubular Products Div., Babcock & Wilcox Co., Dept. HPAC, Beaver Falls, Pa.*

▶ *ULTRASONIC RESONANCE INSTRUMENT*—Two bulletins, V-301 and V-302, discuss uses of "Vindigage" ultrasonic resonance instrument designed for detection of corrosion and laminar flaws and measuring of metal or plastic thicknesses. *Branson Instruments, Inc., Dept. HPAC, Stamford, Conn.*

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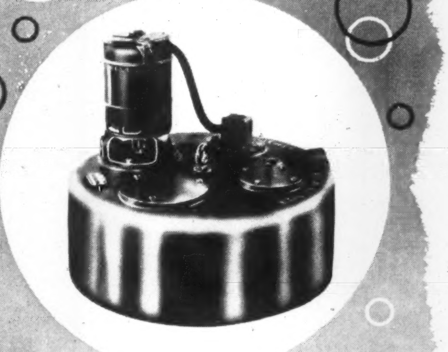
TVC



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26 GALLON RECEIVER
for capacities to
15,000 Sq. Ft. E.D.R.

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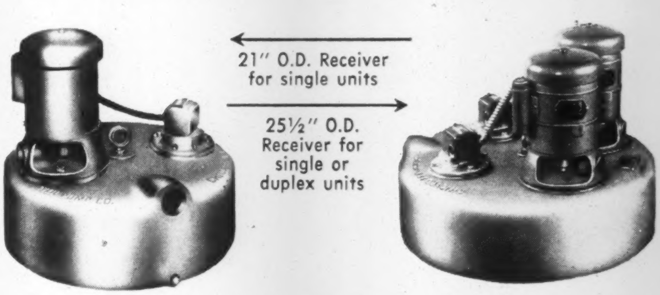
Now Available with 26 GALLON CAST IRON RECEIVER



21" O.D. Receiver for single units

25½" O.D. Receiver for single or duplex units

LOW SPEED — 1750 RPM for long life

Unit Number	Max. Sq. Ft. Direct Radiation	Disch. Press. In Lbs. At Pump	GPM Radiation Will Condense	Capacity of Pump in GPM	Motor H.P.	Return Inlet in Inches	Pump Discharge in Inches	Diameter and Capacity of Receiver	Height of Return to Centerline
TVC-19	750	20	.38	1.5	¼	2	1	21" -10 Gal.	6⅞"
TVC-23	1000	20	.5	1.5	¼	2	1	21" -10 Gal.	6⅞"
TVC-29	2000	20	1.0	3.0	¼	2	1	21" -10 Gal.	6⅞"
TVC-35	4000	20	2.0	6.0	¼	2	1	21" -10 Gal.	6⅞"
TVC-41	6000	20	3.0	9.0	⅓	2	1	21" -10 Gal.	6⅞"
TVC-47	8000	20	4.0	12.0	½	2	1	25½"-15 Gal.	7³⁄₁₆"
TVC-52	10000	20	5.0	15.0	¾	2	1	25½"-15 Gal.	7³⁄₁₆"
TVC-54	15000	10	7.5	22.5	½	3	1¼	25½"-26 Gal.	10½"
TVC-55	15000	20	7.5	22.5	¾	3	1¼	25½"-26 Gal.	10½"
TVC-56	15000	30	7.5	22.5	1	3	1¼	25½"-26 Gal.	10½"
TVC-57	15000	40	7.5	22.5	1½	3	1¼	25½"-26 Gal.	10½"

With these weil TVC Pumps, radiation may be placed as low in the building as desired. Underground gravity return lines are eliminated and overhead discharge lines used. The built-in durability, ease of installation, low cost and efficient operation of the TVC Pump warrants its selection for new installations or replacements.

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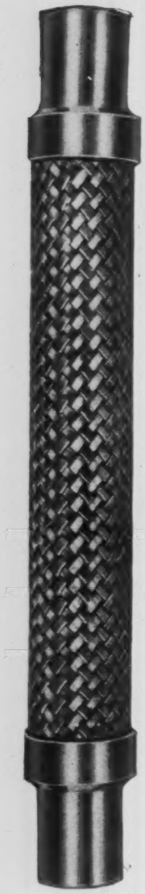

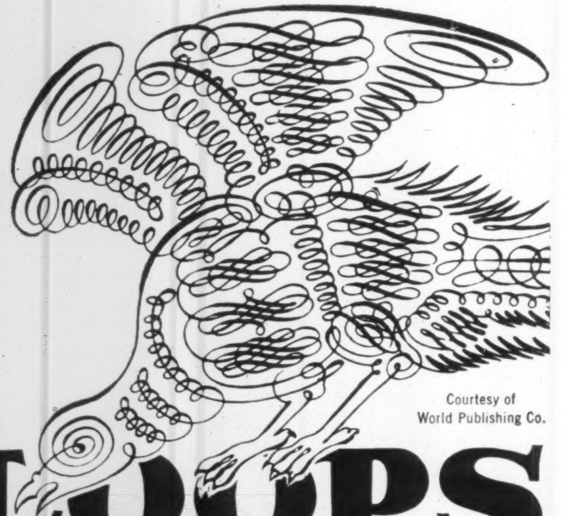

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RECENT TRADE LITERATURE

Continued

▶ *VALVES, FITTINGS*—Illustrations and sizes of valves, fittings, service kits and accessories for refrigeration and air conditioning service appear in 12 page catalog. *Kerotest Mfg. Co., Dept. HPAC, 2514 Liberty Ave., Pittsburgh 22.*

▶ *WATER CHILLER*—Centrifugal water chillers, sizes 150 to 500 tons, covered in new literature, folder No. AC-285. Features, components of packaged units described and illustrated. *Airtemp Div., Chrysler Corp., Dept. HPAC, 1600 Webster St., Dayton 1, Ohio.*

▶ *WATER CHILLER*—Features of new packaged water chiller outlined in specification sheet No. C-1100-S144P. Unit designed for commercial, industrial applications. *Worthington Corp., Dept. HPAC, Harrison, N.J.*

▶ *WATER HEATERS*—New 16 page catalog No. 22 has details of external and internal tankless water heaters, indirect water heaters, mixing valves, water hammer silencers, pipe unions, solder fittings. *General Fittings Co., Dept. HPAC, East Greenwich, R. I.*

▶ *WATER TREATMENT*—Bulletin WDC shows how proper water treatment will reduce hard deposits, congestion, corrosion in wet type dust collectors. Listed are six case histories. *North American Mogul Products Co., Dept. HPAC, Standard Bldg., Cleveland* 13.

▶ *WELDABLE ALLOY*—New 4 page booklet supplies data on weldable alloy "5086" in sheet and plate form. Charts included. *Kaiser Aluminum and Chemical Sales, Inc., Dept. HPAC, 919 N. Michigan Ave., Chicago* 11.

▶ *WELDERS*—Specifications, construction details of "Idealarc" 300, 400, 500 ampere combination a-c and d-c welders supplied in new 4 page booklet. *Lincoln Electric Co., Dept. HPAC, Cleveland* 17. ⌗

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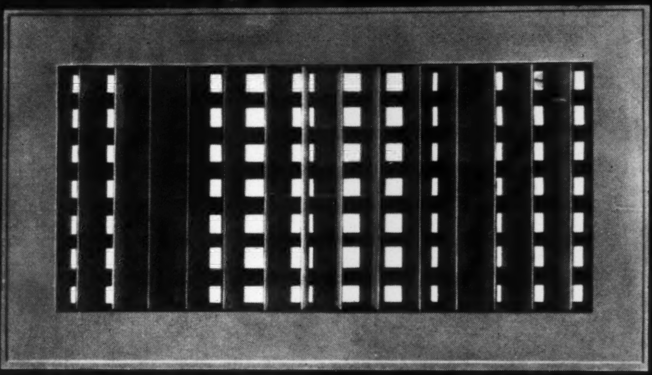
The WORLD-APPROVED LINE of SILENT PERFORMANCE, GREATEST AIR-HANDLING POWER, and PERFECT AIR DISTRIBUTION For WARMING and COOLING AIR CONDITIONING



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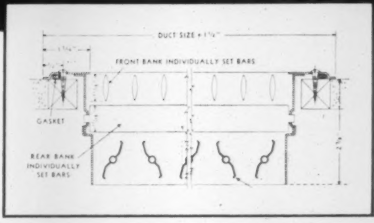
DOUBLE BANKS of Double-Edged STREAM-LINED BARS give any Direction of UP-FLOW, DOWN-FLOW or LATERAL FLOW DESIRED. Use 190 MULTI-FLEX REGISTERS ANYWHERE in COMMERCIAL or RESIDENTIAL Applications — for PERFECT AIR HANDLING and Volume Control — for Complete Satisfaction and Efficiency and ORIGINAL COST ECONOMY.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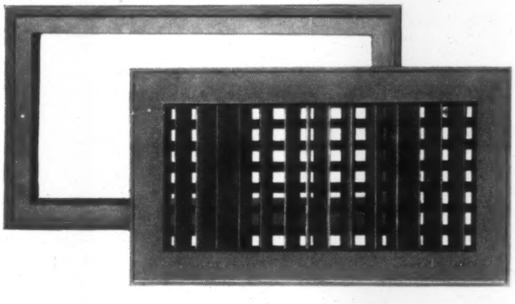

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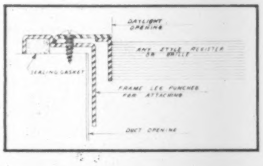
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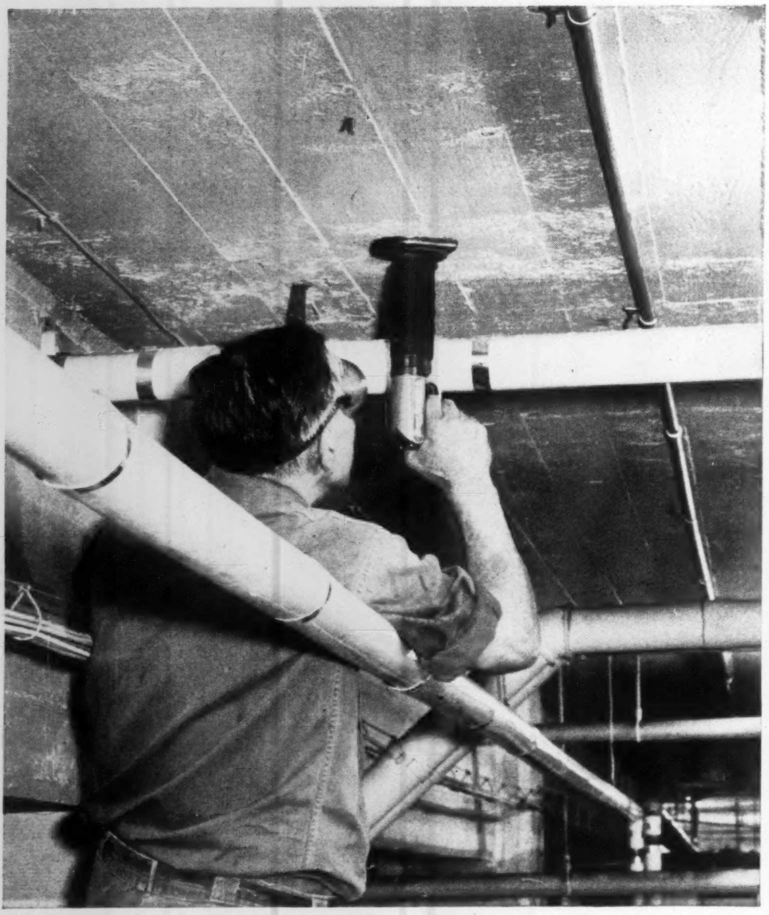

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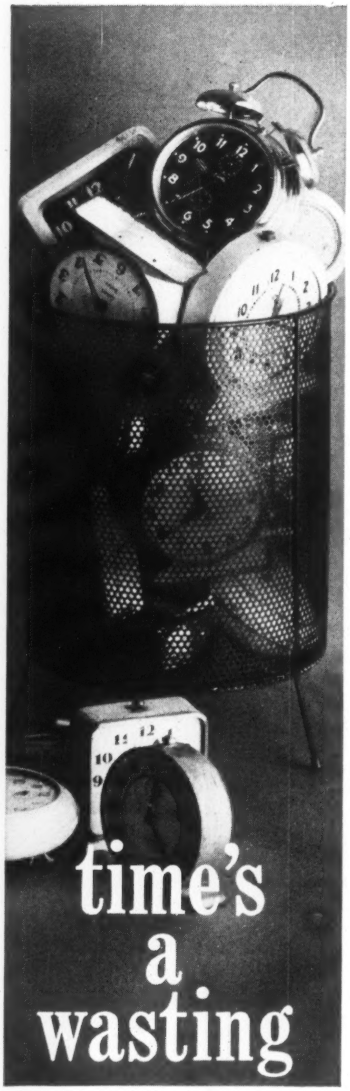

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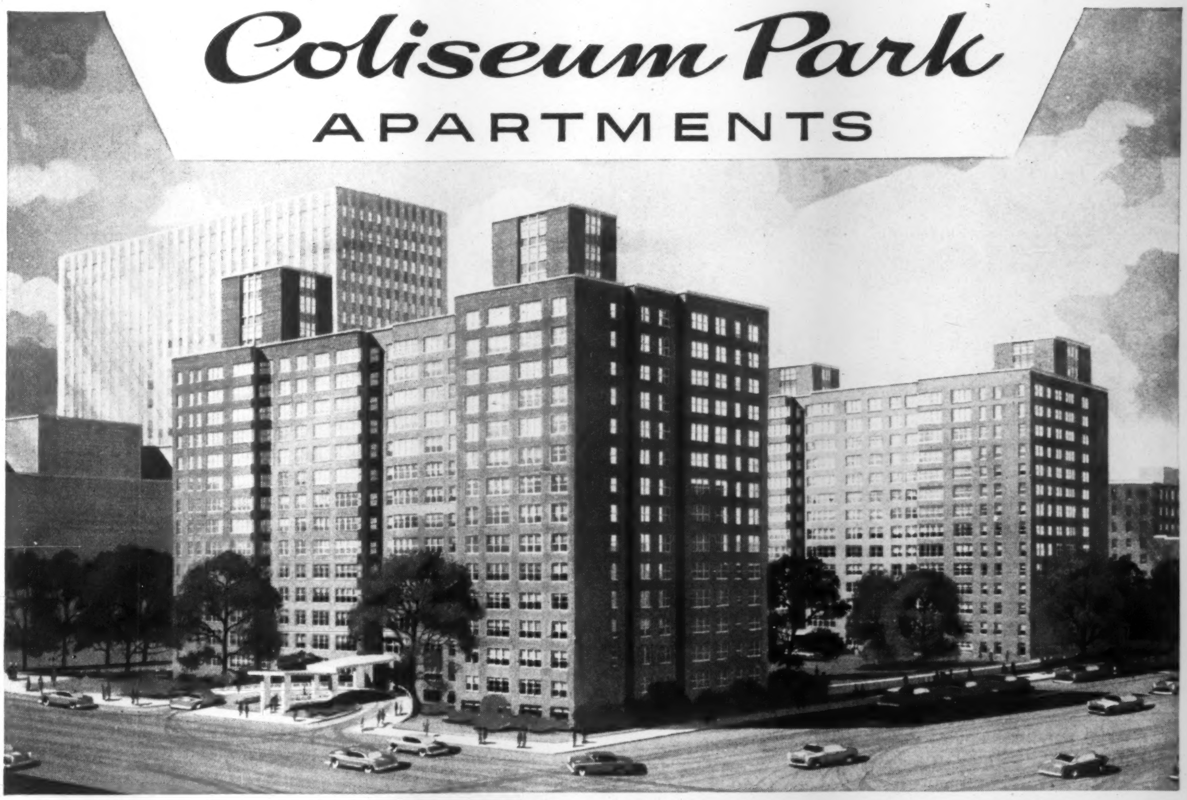
Coliseum Park APARTMENTS



The new Coliseum Park Apartments in New York City are completely air conditioned with 1350 Chrysler's Airtemp Imperial "All-in-wall" units.

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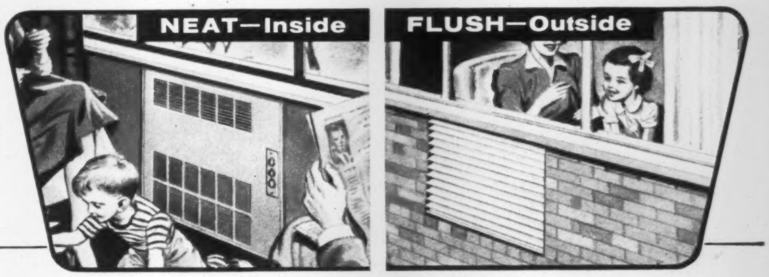

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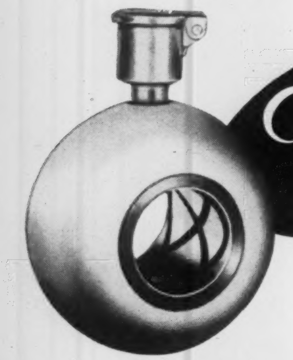

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• self-lubricating

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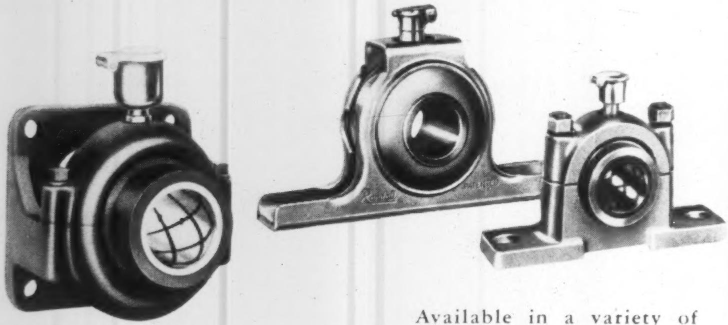

Available in a variety of standard housings and with different types of graphited or sintered bushings, Randall Pillow Blocks are designed so that alignment of the ball assembly with the shaft is automatic under all normal operating conditions. With the additional advantages of initial low cost and easier installation, you have good reason to contact your nearby Randall distributor. He's listed in the yellow pages of the telephone directory under "Bearings."

RANDALL—LEADING DEVELOPER AND MANUFACTURER OF THE AIR-MOVING INDUSTRY'S MOST DEPENDABLE BEARINGS

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1012 S. Greenlawn Avenue, Lima, Ohio

WHO'S WHAT . . .

(New personnel, promotions)

▶ *MECHANICAL CONTRACTORS' CHICAGO ASSOCIATION*—Edward R. Teske, executive secretary. Mr. Teske succeeds the late Thomas M. Cunningham, who died on August 11 after a short illness.

▶ *AIR-CONDITIONING AND REFRIGERATION INSTITUTE*—Frederick J. Reed, chief engineer. Mr. Reed is professor of mechanical engineering at Duke University and chairman of the standards committee of American Society of Refrigerating Engineers.

▶ *DODGE MFG. CO.*—Paul Jordan, director of engineering.

▶ *CERRO DE PASCO CORP.*—Felix S. Dreyer and Richard H. Lewin, directors. Messrs. Dreyer and Lewin are president and executive vice president, respectively, of Lewin-Mathes Co. Div. of Cerro de Pasco.

▶ *COPELAND REFRIGERATION CORP.*—Donald E. Fry, chief engineer; Charles A. Lessing, assistant chief engineer.

▶ *DUNHAM-BUSH, INC.*—Les Garnsey, assistant to president; Chester Silva, general manager of Riverside, Calif., plant.

▶ *POWERS REGULATOR CO.*—R. K. O'Hara, director; J. F. Buckman, vice president and secretary.

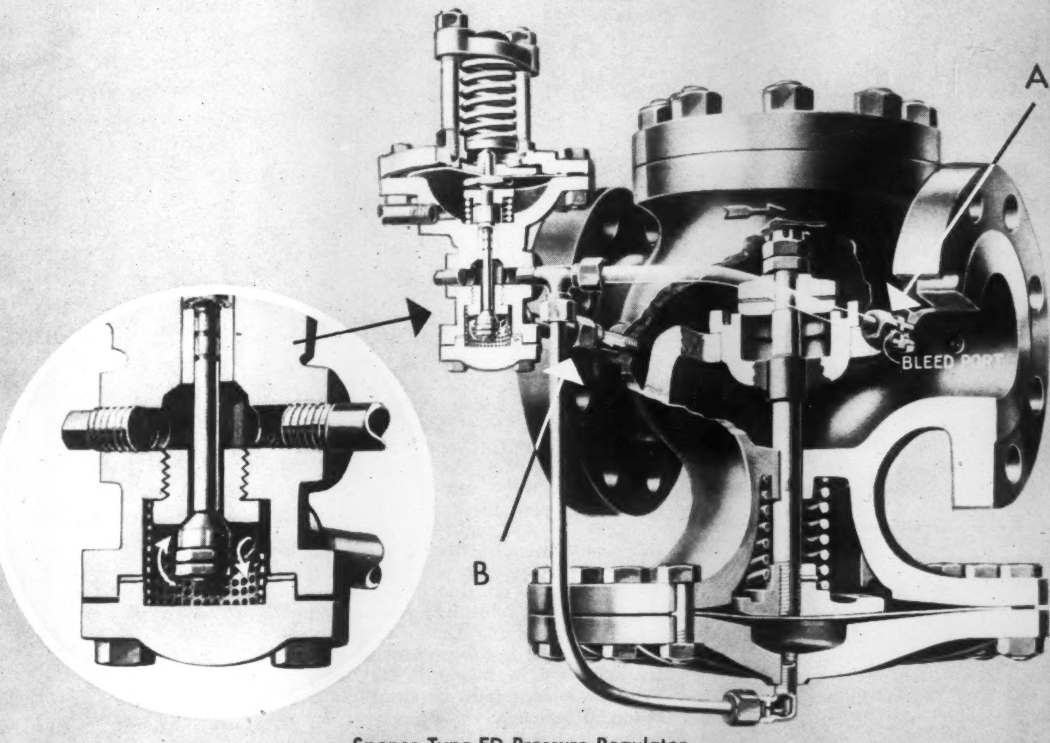
▶ *MODINE MFG. CO.*—Cary Wilson, vice president in charge of sales.

▶ *I. W. AIR CONDITIONING CORP.*—Fred Jacobs, chief engineer.

▶ *ROBERTS-GORDON APPLIANCE CORP.*—Robert T. Huyck, director of research and engineering.

VALVE TIPS:

Advantages of External Pilots in Automatic Regulating Valves



Spence Type ED Pressure Regulator

"Maintenance-free, trouble-free, install-and-forget." They're all pretty phrases, but every engineer knows from experience they don't apply to regulating valves. Any valve designed to control temperatures or pressures within tight limits can be affected by dirt or other foreign matter in steam lines.

One advantage of the external pilot mounting shown above is simplified maintenance. Trouble shooting is faster, downtime is reduced, and tempers don't take such a beating. Here's why:

If trouble develops, it's easy to find out if it's in the pilot or the main valve. Just remove the tubing bend at A. A simple test, without any instruments or other equipment, shows where the trouble is.

If the trouble is in the pilot, you can remove it by disconnecting the unions at B. There's no need to take the main valve out of the line.

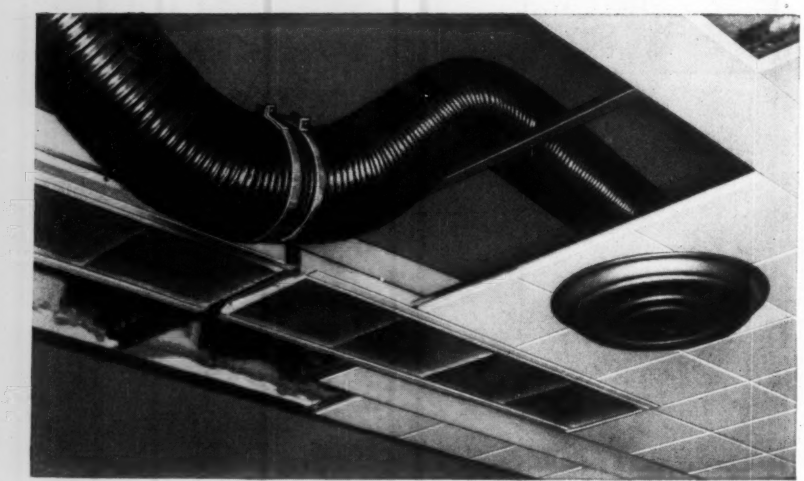
The quickest way to get the regulator functioning again is to install a spare pilot. This is easy — and in the Spence design it's not expensive to carry spare pilots. Spence pilots fit all sizes of Spence main valves. There's no need to stock an expensive inventory of pilots for each main valve size.

In the enlarged sectional drawing above, you can see how the strainer, seat and disc of the pilot are readily accessible by removing the blind flange.

If the trouble is in the main valve, here again inspection is easy. If there's dirt in the steam line, it may clog the bleed port or restriction orifices. In the Spence design these can be inspected and cleaned by merely removing the tubing connections. The seat and disc of the main valve can also be inspected easily by removing the top flange.

These maintenance advantages, plus other advanced design features, are available for a wide range of regulating applications. For information on Spence's wide range of different automatic regulating valves, write for your copy of Bulletin 1005.

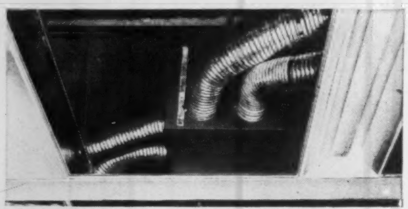
SPENCE ENGINEERING COMPANY, INC.
Walden, New York



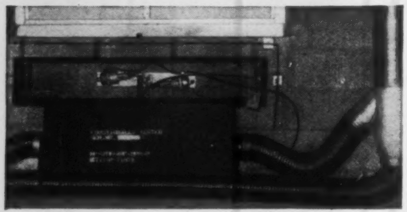
Indiana Nat'l Bank Bldg., Indianapolis—Wiremold Air Duct runout from branch duct to ceiling diffuser.

READILY RELOCATED

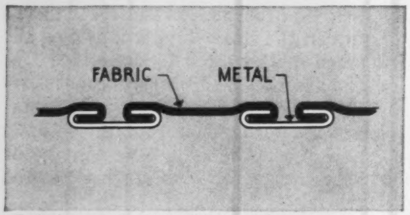
Flexibility of Wiremold Air Duct lets you move diffusers anywhere, anytime



Socony Mobil Bldg., N. Y. C.—Wiremold Air Duct "octopus" in a high-velocity air conditioning system.



Cuyahoga County Bldg., Cleveland—Wiremold Air Duct connects hot and cold risers to underwindow units.



Exclusive construction—fabric component and supporting steel spiral are mechanically interlocked.

Wiremold Air Duct, the flexible connector, helps make air conditioning systems versatile. It provides a simple way to adjust for any variations from initial plans, or changing tenant requirements. And both diffuser and Wiremold Air Duct can be moved without disturbing permanent equipment.

Made by an exclusive process that mechanically interlocks the fabric with the supporting steel spiral, there is no glue to dry out and cause duct failure. As a result, Wiremold Air Duct provides long life and good performance. Its light weight makes it easy to handle — especially important in cramped quarters.

other advantages

- **good air flow with minimum pressure loss**
- **no air leakage at normal operating pressure**
- **meets National Board of Fire Underwriters requirements**
- **compensates for misalignments between connections**
- **allows for future relocation of units**
- **acts as a vibration damper**
- **easy to cut, fit and install**

SEND FOR FOLDER NO. 591 for further information on Wiremold Air Duct.

WIREMOLD® FLEXIBLE AIR DUCT

THE WIREMOLD COMPANY, HARTFORD 10, CONNECTICUT

WHO'S WHAT

Continued

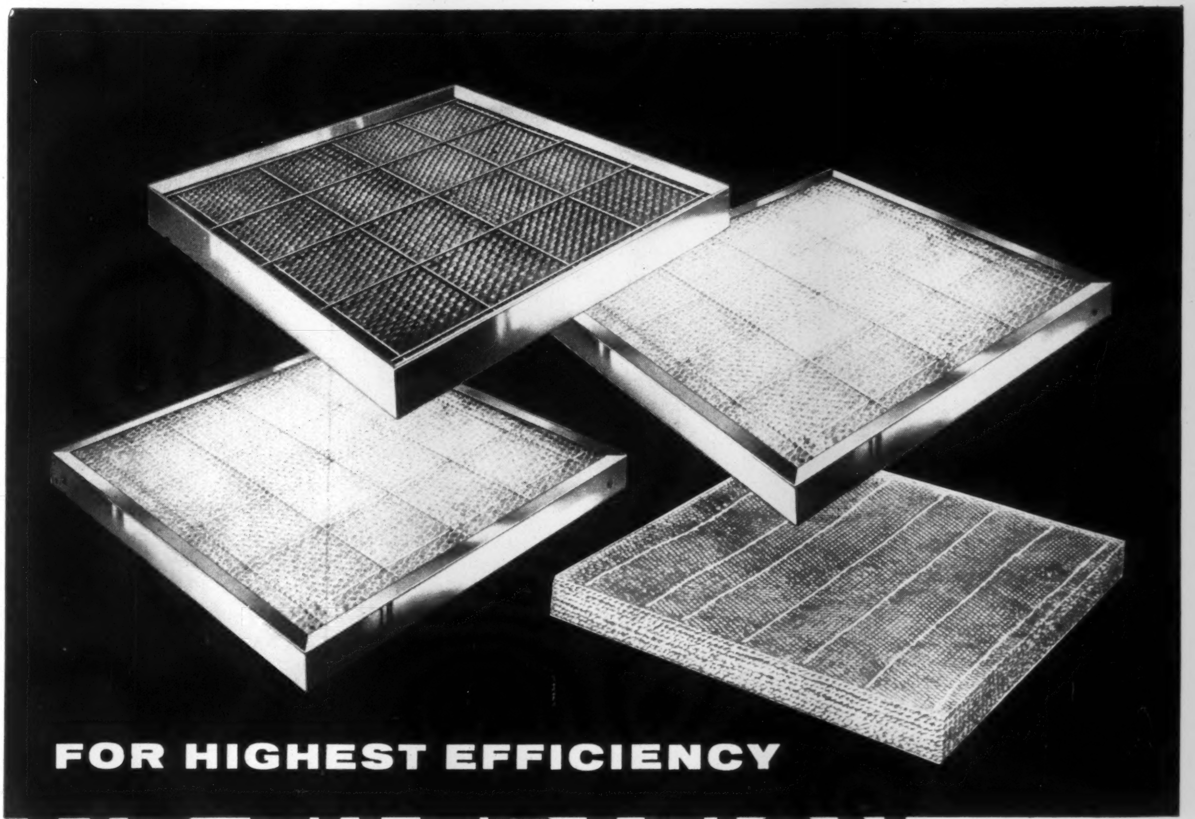
▶ *AIR MOVING AND CONDITIONING ASSOCIATION*—Members of three committees have been named. These are: *Certified ratings*—E. E. Trickler, New York Blower Co. (chairman); H. F. Brinen, Young Radiator Co.; W. A. Curtis, Peerless Electric Co.; E. W. Peterson, American Blower Div. of American-Standard; E. J. Stone, Propellair Div., Robbins & Myers, Inc.; J. W. Wilcock, Sturtevant Div., Westinghouse Electric Corp. *Engineering*—H. R. Bohanon, Acme Equipment Co.; W. A. Curtis, Peerless Electric Co.; C. O. Fury, Clarage Fan Co.; J. E. Gill, Buffalo Forge Co.; J. J. Merrick, John J. Nesbitt, Inc.; R. E. Parker, Ilg Electric Ventilating Co. *Standards*—Mr. Bohanon, Mr. Brinen, J. J. Friedler, Ilg Electric Ventilating Co.; L. G. Malissa, Penn Ventilator Co.; J. W. Mathis, New York Blower Co.; G. E. Szekely, Bayley Blower Co.

▶ *ALUMINUM CO. OF AMERICA*—Arthur Vining Davis, honorary chairman. Mr. Davis, who has served Alcoa as a director since 1892 and as chairman since 1928, has resigned from the company to devote his time to other interests.

▶ *JOSEPH T. RYERSON & SON, INC.*—Wilford O. Schwartz, sales manager for St. Louis steel service plant; Frank W. Ingold, a similar appointment for Cincinnati steel service plant; Stanley J. Miller, assistant director, plant engineering division, Chicago.

▶ *LAU BLOWER CO.*—Thomas I. Byrd, president; Harold W. Faulkender, chairman of the board; Emory L. Mainous, Dayton division works manager.

▶ *TRANE CO.*—T. W. Ernst, president of Heating & Cooling Coil Manufacturers Association for 1957-58. Mr. Ernst is manager of Trane's coil sales department.



FOR HIGHEST EFFICIENCY AIR FILTRATION

RP AIR FILTERS

FOR RESIDENTIAL, COMMERCIAL, INDUSTRIAL APPLICATIONS

EZ KLEEN

The aluminum, washable air filter that features easy cleaning and moderate cost. Standard E Z Kleen in ½″, 1″ and 2″ thicknesses—350 F.P.M. rating. Multi-Velocity E Z Kleen in 1″ and 2″ thicknesses—520 F.P.M. rating. Easily washed and re-coated with Filter-Coat (dust and dirt removing adhesive) or Super Filter-Coat (dust and odor removing adhesive) for like-new efficiency.

GREASE FILTER

Aluminum grease filters for kitchen exhaust systems. End grease nuisance and resulting costly maintenance to motor and blower equipment...reduce fire hazard ...increase sanitation. Attractive aluminum improves kitchen appearance. Strong, lightweight, easy-to-handle.

INDUSTRIAL FILTER

Economical, lightweight, easy-to-clean, aluminum filters for both high or low velocities. Reduce operating costs through longer service life and top performance. Ideal for new or existing installations.

PAINT ARRESTORS

Inexpensive, disposable filter pads that remove paint overspray solids from exhausted air in paint spray booths. Simple installation, using holding frames, in banks of any size. R P Paint Arrestors are efficient in operation...versatile...economical in operating and initial costs...save floor-space...reduce down-time.

WRITE FOR COMPLETE INFORMATION

RP ... PRODUCTS OF RESEARCH

RESEARCH PRODUCTS *Corporation*

Dept. 46, Madison 10, Wisconsin

AFI MEMBER

WHO'S WHAT

Continued

▶ *TUTTLE & BAILEY*—James H. Faller, assistant sales manager of air distribution division.

▶ *WHEELABRATOR CORP.*—James F. Connaughton, executive vice president; Harold M. Miller, senior vice president; Jacob A. Schmidt, Jr., secretary-treasurer; John M. Wolf, controller; Edward T. Sullivan, assistant secretary-assistant treasurer.

▶ *MITCHELL MFG. CO., DIV. OF CORY CORP.*—Howard G. Haas, vice president in charge of sales for room air conditioner division.

▶ *HOLMES & NARVER, INC.*—Named assistant vice presidents are: Russell Field, Wylie F. Nance, David L. Narver, Jr.

▶ *AMERICAN AIR FILTER CO., INC.*—Elected to membership of working committees of Producers' Council, Inc. are: John Frazier, marketing research committee; Jack O'Neil, merchandising committee. Messrs. Frazier and O'Neil are sales promotion manager and assistant advertising manager, respectively, for AAF.

▶ *ARMSTRONG CORK CO.*—Kenneth O. Bates, director of the company's program for the development of major new products and markets. Mr. Bates is executive vice president of the company.

▶ *ORANGEBURG MFG. CO.*—William B. Schutz and Harry N. Dietz, managers of bituminous pipe sales and fiber conduit sales, respectively.

▶ *H. K. PORTER CO.*—E. G. Counselman, manager of industrial sales. William E. Haines, Director of Industrial Defense, Department of Commerce, succeeds Mr. Counselman as Washington, D.C., representative.

▶ *AIR REDUCTION CO., INC.*—E. F. O'Connell, appointed chairman of the cost records subcommittee on standardization by American Association of Cost Engineers. Mr. O'Connell is Air Reduction's chief estimator.

▶ *BURNHAM CORP.*—V. A. Good and Albert J. Hall, managers of heating and cooling and steel products divisions, respectively.

▶ *TEXAS VITRIFIED PIPE CO.*—David E. Clemens, assistant general manager.

THIS EDGE HIGH

NEW Metal Blade Aeromaster* Fan

AEROMASTER fans 54" to 22' for cooling towers and radiator-type coolers.

Lasts Longer • Costs Less

Efficiency . . . economy . . . durability—three important standards—are yours in the AEROMASTER fan.

AEROMASTER fans are efficient because they embody advanced aerodynamic principles. True airfoil blade sections give maximum air delivery.

AEROMASTER fans are economical because adjustable pitch angle of the blade permits a flexibility of setting which enables you to decrease fan load to an accurate minimum horse-power requirement. Design features reduce labor and installation costs.

AEROMASTER fans are durable because they are made from corrosion resisting, silicon-magnesium, aluminum alloys with high tensile strength, fine grain structure and increased endurance limit.

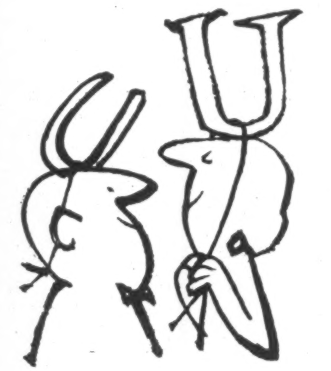
For more details write to KOPPERS COMPANY, INC., Aeromaster Fan Dept., 6809 Scott Street, Baltimore 3, Md.

*Koppers Trademark

KOPPERS

Aeromaster Fans

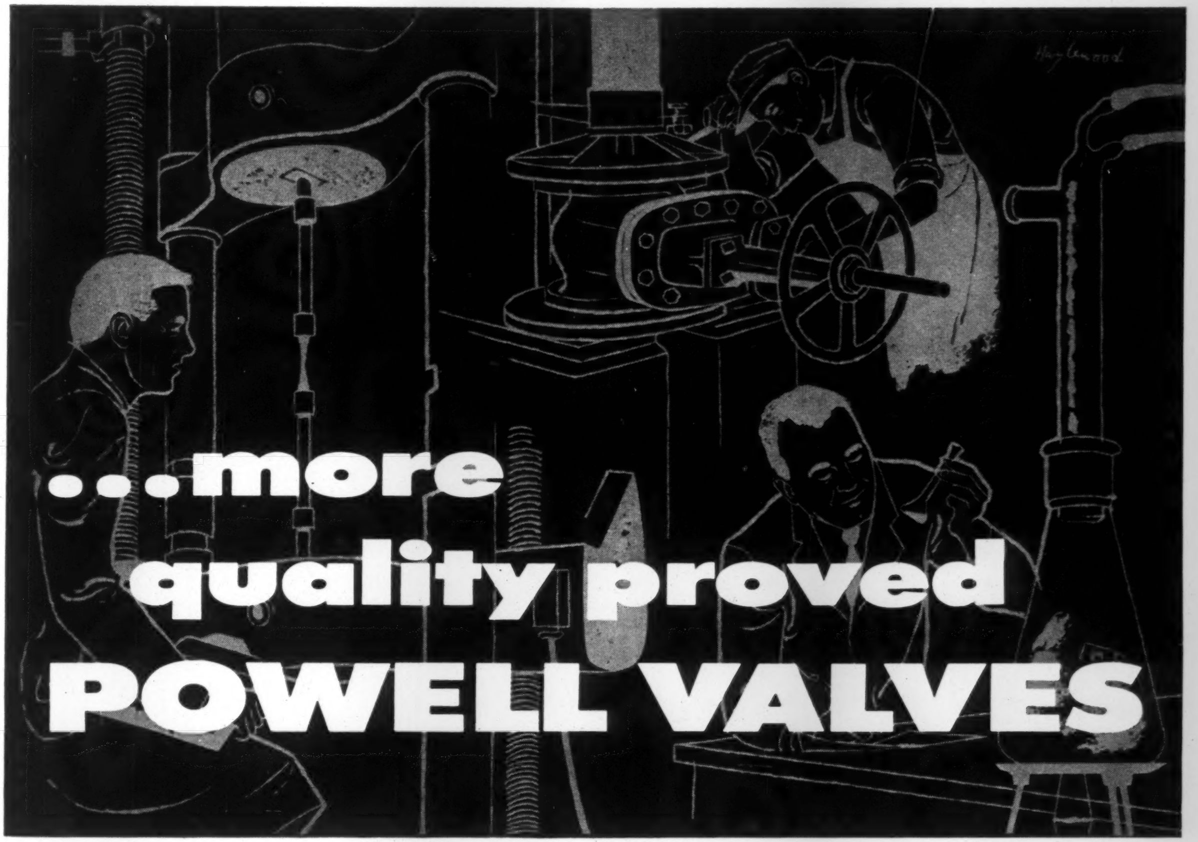
Engineered Products Sold with *Service*



We're giving the

United Way

How about you?


...more
quality proved
POWELL VALVES

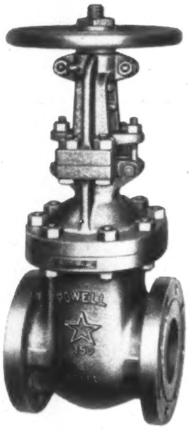


FIG. 1503—Steel O.S.&Y. Gate Valve for 150 Pounds W.S.P.

FIG. 241—Iron Body, Bronze Mounted O.S.&Y. Globe Valve for 125 Pounds W.S.P.

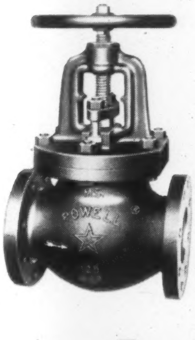


FIG. 3061—Steel Swing Check Valve for 300 Pounds W.S.P.

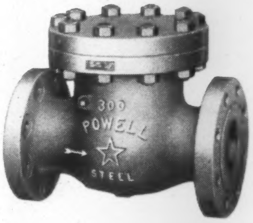
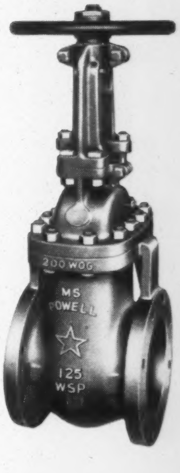

300
POWELL
STEEL

FIG. 1793—Iron Body Bronze Mounted O.S.&Y. Gate Valve for 125 Pounds W.S.P.


200 WOG
MS
POWELL
125
WSP

for dependable flow control

Consult your Powell Valve distributor for full facts about quality proved bronze, iron, steel and corrosion-resistant valves. For every flow control problem—there is a Powell Valve to solve it.

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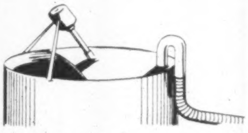
POSITIVE

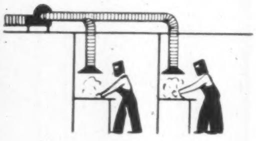
FUME CONTROL

FLEXAUST® HOSE

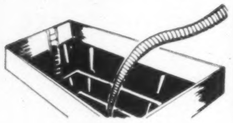
is the answer!



. . . in chemical work,



. . . or welding,



. . . space ventilating

It doesn't really make any difference *what* the application is . . . . Flexaust is ready and able to perform it easily and economically.
Made of strong neoprene coated cotton or nylon fabrics spiral wire reinforced.
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Extremely flexible, durable, and lightweight.
Exceptionally easy to cut, install, connect, reuse, and relocate.
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STEAM SPECIALTY COMPANY, INC. 40-20 22nd St., Long Island City, 1, N.Y.

WHO'S WHAT

Continued

▶ *HOOKER ELECTROCHEMICAL CO.*—James S. Sconce, technical assistant to management. New research managers appointed are: Dr. J. Howard Brown, phosphorus chemistry research, analytical and physical chemistry laboratories, and another laboratory being planned; Morton S. Kircher, inorganic and electrochemical research, and the Virgo laboratory; Dr. Jack S. Newcomer, organic chemical research.

▶ *SUNDSTRAND MACHINE TOOL CO.*—For Hydraulic Div.: Sereno A. Ferraro, field service manager; James R. Holmin, manager of headquarters service facilities.

▶ *TURNER BRASS WORKS*—Lester M. LaPole, sales promotion manager.

▶ *DOLE REFRIGERATING CO.*—George S. Keeler, secretary and assistant to president.

▶ *CONTROLS CO. OF AMERICA*—Louis Putze, chairman (chief operating officer) of Chicago chapter of Young Presidents Organization.

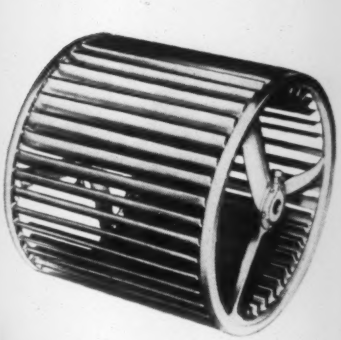
▶ *BORG-WARNER CORP.*—Tom Conway, director of manufacturing services.

▶ *ROCKWELL MFG. CO.*—Munro Corbin, vice president and assistant to president; John T. Farrell, controller, succeeding Mr. Corbin; Paul A. Manor, chief engineer, central valve research and development department.

▶ *TORRINGTON MFG. CO.*—Leonard C. Lindstrom, sales manager of air impeller division.

▶ *UNION CARBIDE CHEMICALS CO., DIV. OF UNION CARBIDE CORP.*—Elbert E. Husted, appointed to fluorocarbon sales department.

7 WAYS BETTER



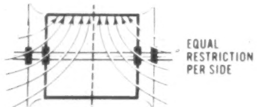
MORRISON

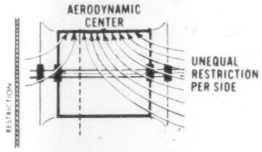
END SUPPORTED WHEEL

1 MAXIMUM UTILIZATION

Under unrestricted inlet conditions the aerodynamic center and the exact geometric center are the same in both Morrison End Supported wheels and center plate wheels.

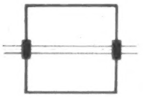
BUT when one inlet of the blower is MORE restricted than the other, the aerodynamic center only in an end supported wheel moves toward the restricted side to permit greater use of the unrestricted side. Center supported wheels, however, starve the restricted side of the blower, and the unrestricted side cannot compensate for it.

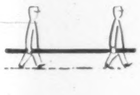

EQUAL
RESTRICTION
PER SIDE


AERODYNAMIC
CENTER
RESTRICTION
UNEQUAL
RESTRICTION
PER SIDE

2 STABLE SUPPORT

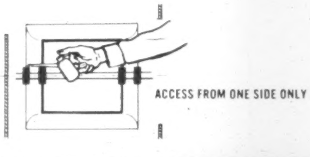
Morrison End Supported Wheels are mounted stably on the shaft, eliminating rocking action that causes wheel wobble.





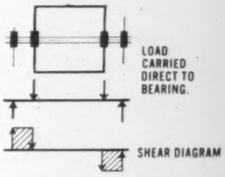
3 EASY MAINTENANCE

The Morrison End Supported Wheel offers easy oiling. Oil one end; then reach through the wheel to oil the other end. You need no complicated and costly oil tube extension.


ACCESS FROM ONE SIDE ONLY

4 MINIMUM SHAFT LOADING

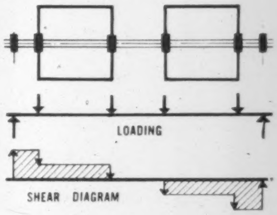
Morrison End Supported Wheels carry load directly to bearings, relieving strain and eliminating shaft whip. Center plate wheels put added strain on the shaft, causing bending, and shaft whip and requiring larger shafting.


LOAD
CARRIED
DIRECT TO
BEARING.
SHEAR DIAGRAM

5 UNIFORM DISTRIBUTION

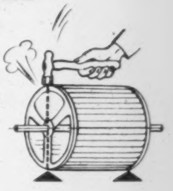
(for twin blowers)

Uniform load distribution permits using smaller shafting . . . prevents shaft whip . . . allows longer blower life . . . minimizes maintenance costs.


LOADING
SHEAR DIAGRAM

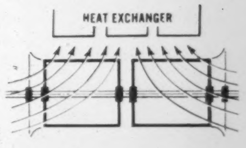
6 STRONGER FRAME

Sturdy end rings directly support impact on the ends of the Morrison End Supported Wheel and aid safe shipment. Impact on end of center plate wheel lacks sturdiness; distortion results.



7 EXTRA WHEEL ADVANTAGE

In special applications of two wheels for wide air distribution, the Morrison End Supported Wheel makes possible the greater distribution of air.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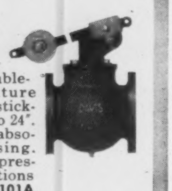
VALVE SPECIALTIES FOR **STEAM, AIR OR GAS**

Davis offers a complete line of valve specialties including relief valves, altitude valves, pump governors, pressure regulators and emergency valves. No matter what the control problem, there's a Davis specialty product to meet the need. Contact Davis today for precision control valves.

No. 401 PRESSURE REGULATOR
Everything you want for pressure reducing and control service on steam, air or gas. Spring loaded, balanced disc construction for indoor or outdoor service. Range of size: ½ to 10"... initial pressures to 600 psi... reduced from 500 down to 1 psi. Controller attached or remote. Request **Catalog 200**.

No. 80 BACK PRESSURE VALVE
For automatic control of exhaust steam for heating and processing use. Semi-balanced double-port valve. Temperature compensated to avoid sticking. Standard sizes 2 to 24". Davis No. 81 style for absolutely drip-tight closing. Davis No. 82 where both pressure and vacuum conditions prevail. Ask for **Bulletin 101A**.



No. 101—No. 102 BOILER STOP AND CHECK VALVES

No. 101—For high pressure heavy duty steam plants. External oil dash pot... counter-weighted lever for testing and visible action. Clean, simple inner construction.

No. 102—Popular valve for general service. Internal steam dash pot eliminates chatter.

Both valves in complete size ranges, corner or elbow, semi-carbon or alloy steel bodies with trim to suit pressure or temperature needs. Ask for **Bulletin 101A**.

SEND FOR COMPLETE FILE OF LITERATURE

Davis
DAVIS REGULATOR COMPANY
2541 So. Washtenaw • Chicago 8, Illinois

WHO'S WHAT

Continued

▶ *THOR POWER TOOL CO.*—William J. McGraw, manager of electric tool sales division; John Trumble, factory manager of Aurora, Ill., works. For SpeedWay Mfg. Div.: J. B. Dempsey, vice president to direct marketing expansion; G. R. Winkley, vice president; A. E. Feiereisel, vice president of engineering.

▶ *WORTHINGTON CORP.*—William A. Meiter, vice president, employee relations and organization development.

▶ *WESTINGHOUSE ELECTRIC CORP.*—Carl E. Cannon, assistant to merchandising manager of air conditioning division; Francis E. Davison, assistant to vice president of steam division; H. Thompson Duff, budget administrator, succeeding Mr. Davison.

▶ *OSTER MFG. CO.*—Lester D. Martin, vice president and director. Mr. Martin succeeds Arthur S. Gould, retired.

▶ *WATER SERVICE LABORATORIES, INC.*—Milton W. Snyder and Harvey Levitt, appointed to engineering and chemical departments, respectively.

▶ *OLIN MATHIESON CHEMICAL CORP.*—Sam Gurley, Jr., vice president of sales for Olin Aluminum.

▶ *DOLE REFRIGERATING CO.*—Harold P. Hansen, executive vice president.

▶ *BOHN ALUMINUM & BRASS CORP.*—Blake Thomas, general manager of Betz Div.

▶ *CHASE BRASS & COPPER CO.*—Peter S. Barno, vice president, public and industrial relations, and a director; Leslie A. Cretty, manager of product development at Waterbury

for peace of mind when the pressure is on...

...Capitol 3000# and 6000# forged steel couplings

for all high-pressure installations

Full couplings and half couplings are available from stock for prompt shipment in all sizes from 1/8" through 4".

Manufactured to ASTM Specifications A-105.

ORDER EVERY TYPE OF COUPLING FROM

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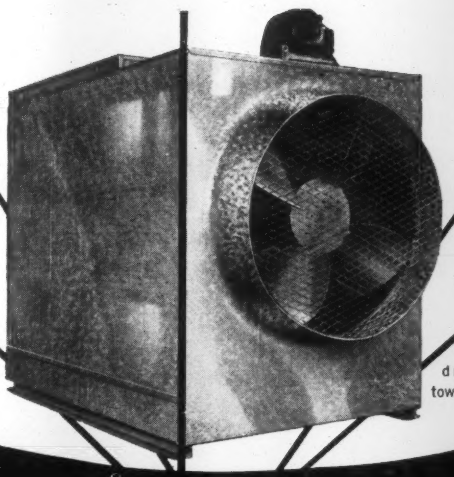
MFG. & SUPPLY CO.
COLUMBUS, OHIO

COUPLINGS — NIPPLES — UNIONS — BUSHINGS — PLUGS — REDUCERS — CAPS—CAPADAPTERS—WELL SUPPLIES



Series CF horizontal induced draft tower. Vertical induced draft and natural draft towers also available.

DOVER TOWERS

ARE HOT DIP GALVANIZED*

TO STOP RUST COLD!

*After Fabrication

Why Dover Hot-Dip Galvanizes *After* Fabrication

Why doesn't Dover simply use *mill galvanized* steel? The answer is simple — the results are important. Shearing, braking, forming and welding operations on mill galvanized steel tends to destroy the zinc coating, leaving certain spots unprotected. Once the protective zinc coating is removed, rust and corrosion go to work causing costly damage. For this reason, Dover does all the fabricating first, and *then* hot dips the entire assembly. The result is complete protection against rust and corrosion.

No Costly Rust, Corrosion No Unsightly Appearance

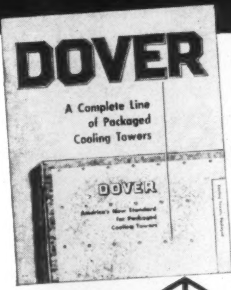
Dover packaged cooling towers, 2 to 100 tons capacity, are hot-dip galvanized after fabrication for two very important reasons; first, to provide you with a cooling tower that will not be damaged by costly rust and corrosion. Second, to provide you with a tower that will stay new looking after many months of use.

ONLY DOVER GIVES YOU THIS COMPLETE ASSURANCE AND PROTECTION AT NO ADDITIONAL COST!

FREE OFFER

DOVER PACKAGED COOLING TOWERS MEET THE RIGID REQUIREMENTS OF THE NEW YORK CITY DEPARTMENT OF BUILDING

Send today for a copy of Dover Catalog. Gives all the facts and specifications of Dover's complete line.



DOVER

A Complete Line of Packaged Cooling Towers

DOVER

America's New Standard for Packaged Cooling Towers

DOVER Mfg. Co.
Dept. 100, 3117 Weatherford Ave., Independence, Missouri
☐ Send copy of Dover Catalog.
☐ Send name of nearest Dover representative.

NAME ____________________

FIRM ____________________

ADDRESS ____________________

CITY ____________ ZONE ____ STATE ________

DO YOU HAVE A TWO-STAGE PRESSURE OR TEMPERATURE CONTROL PROBLEM ?

MERCOID® HAS THE SOLUTION

Mercoid DA-400 Series Controls are dual purpose controls (available for pressure or temperature) incorporating a single element operating two separate independently adjustable Mercoid magnetic mercury switches. Circuit arrangements can be supplied for various operations, a few examples are:

1. Close one alarm circuit at high setting and a separate circuit at low setting. Both circuits remain open between the high and low operating points of the two switches.

2. As an electrical interlock to open one circuit on a rise above, and the second circuit on a drop below the set operating point.

3. To provide two-stage control by opening one circuit on a rise and a second circuit on a further rise.

***Pressure types* available in 17 different operating ranges from 0-30" vac. to 300-2500 psi. *Temperature types* available in 11 operating ranges from -30-60°F. to 370-530°F.**

MERCOID
SWITCH
MERCOID
SWITCH

All types are equipped with external adjustments and visible calibrated dial.

Our engineers are at your service—send in your control problem or
WRITE FOR BULLETIN CA-PT

THE MERCOID CORPORATION
4211 Belmont Ave., Chicago 41, Ill.

WHO'S WHAT

Continued

Mfg. Co. plant; Henry F. O'Shaughnessy and David M. Andrews, general superintendent and superintendent of maintenance, respectively, at Chase Metal Works plant.

▶ *BULLARD CO.*—E. C. Bullard, chairman of the board and chief executive officer; E. P. Bullard, III, president and general manager.

▶ *PHILIP CAREY MFG. CO.*—D. L. Bigelow, manager of insulation sales, insulation division.

▶ *CURTIS MFG. CO.*—T. B. Levene, manager of production control and purchases.

▶ *ALLOY STEEL PRODUCTS CO.*—Harold J. Balhouse, manager of newly formed nuclear division.

▶ *BAYLEY BLOWER CO.*—Frank J. Hamilton, general manager.

▶ *NATIONAL INDUSTRIAL SERVICE ASSOCIATION*—Joseph M. Harrington, executive vice president.

▶ *AIR REDUCTION CO., INC.*—Dr. Shadburn Marshall, director of metallurgical research.

▶ *MILTON ROY CO.*—John A. Mitchell, assistant to president; John P. Klembeth, assistant chief engineer. Mr. Mitchell replaces G. J. Wilson who was recently appointed general manager of the company's new plant in St. Petersburg, Fla.

▶ *WESTINGHOUSE ELECTRIC CORP.*—E. W. Seay, manager of general advertising.

▶ *HAGAN CHEMICALS & CONTROLS, INC.*—Basil Q. Welder, head of boiler chemical sales.

APPLYING INSULATION TO PIPING?

There are 12 sound reasons why you should try:

Swift's
Improved
LAGGING ADHESIVE

There is an improved way to apply insulation. Whether you're bonding insulation to piping or adhering lagging cloth to insulation, Swift's Lagging Adhesives give you 12 important advantages:

1. EASY TO USE
2. FAST SETTING
3. NON-HAZARDOUS
4. FLAME-RESISTANT FILM
5. MOISTURE RESISTANT
6. MOLD RESISTANT
7. GOOD UNDERCOATING FOR PAINT
8. ADHESIVE PROPERTIES
9. FLEXIBILITY
10. SAVES PAINT
11. UNIFORM
12. MEETS ACCEPTED SPECIFICATIONS

See the superiority of Swift's new Lagging Adhesives *for yourself* . . . Write for details on an introductory trial shipment, at quantity price.

SWIFT & COMPANY
Adhesive Products Dept.,
4115 Packers Ave.,
Chicago 9, Illinois

WRITE FOR LITERATURE

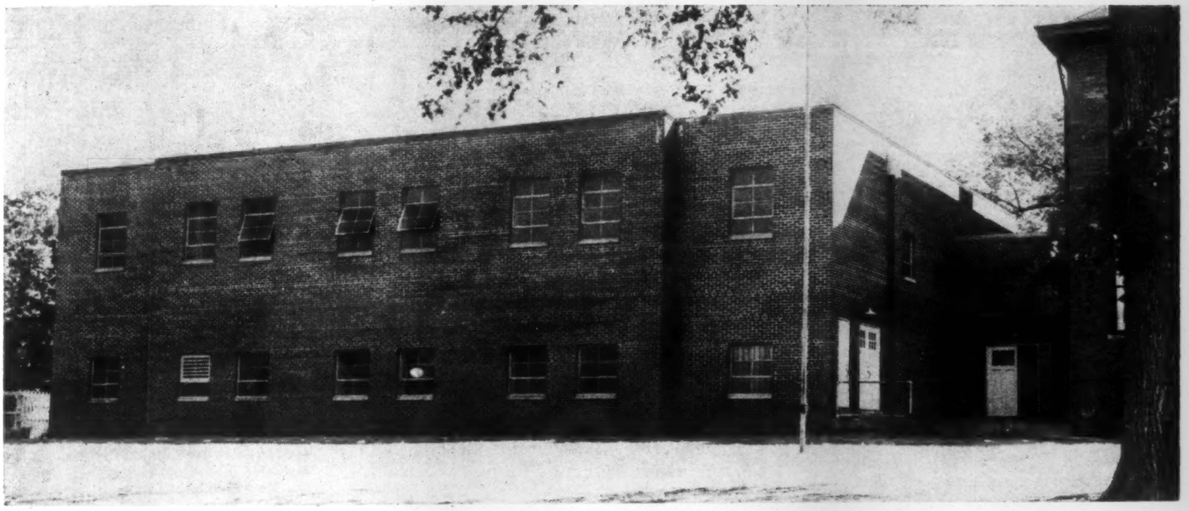
SWIFT'S
LAGGING ADHESIVES

Swift
102nd YEAR

To Serve Your Industry Better

Campbell

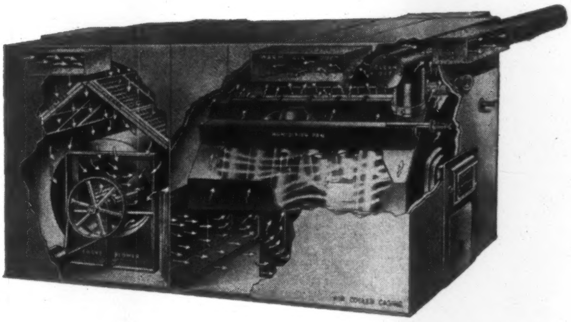
WARM AIR HEATERS FOR LARGE BUILDINGS



School Gymnasium, Essex, Iowa, economically heated with a No. 8075 gas-fired Campbell Heater. Installed in 1950 by Essex Hardware Co. Essex, Iowa.

OUTSTANDING PERFORMANCE

More and more architects and contractors are specifying Campbell for practical warm air heating of large buildings. Campbell Heaters give extra value in all the factors that assure customer satisfaction. They are moderately priced and are easy to install; they deliver quick, abundant heat with exceptional fuel economy; and they give long, dependable service. Available for all fuels in capacities up to 3,150,000 BTUs. Your inquiry will receive our prompt attention.



MANUFACTURERS' AGENTS
We have some very attractive openings for men calling on heating contractors and architects.

CAMPBELL
HEATING COMPANY

DES MOINES 17, IOWA

QUIET
mechanical
equipment
operation
now possible
...roof to
basement...
by installing
on Korfund
Mounts

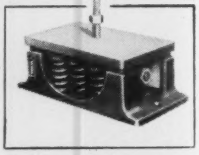
Heavy fans, pumps, compressors and other equipment mounted on Korfund vibration and noise control mounts run smooth and quiet. Machinery installations can be made anywhere in a building without fear of annoyances. Whether you're planning to install new mechanical equipment, or are troubled by your present system it will pay you to call Korfund.

Korfund offers a complete line utilizing springs - rubber - cork alone or in combination...

For Example:

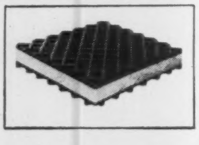
Vibro-Isolators

For Critical Installations. Spring assembly floats vibrating equipment, stops vibration and noise transmission. Satisfaction guaranteed.



Elasto-Rib

For non-critical installations. Multi-purpose cushion dampens noise, economically checks vibration.



Bulletin No. 48 describes the Korfund line and tabulates isolation requirements for different types of equipment and building conditions. Yours for the asking—write today.

THE KORFUND COMPANY, INC.
KORFUND VIBRATION CONTROL
SPRINGS RUBBER CORK
48-01F Thirty Second Place, Long Island City 1, N. Y.
In Canada: 510 Canal Bank, Ville St. Pierre, Montreal

WHO'S WHAT

Continued

▶ *ACME INDUSTRIES, INC.*—Jack J. Bacsik, service manager.

▶ *HAMMEL-DAHL CO.*—William R. Kennedy, assistant sales manager.

▶ *IRON FIREMAN MFG. CO.*—Frank Kalinowski, sales promotion manager.

▶ *RHEEM MFG. CO.*—Earle M. Jorgensen, a director.

▶ *MANNING, MAXWELL & MOORE, INC.*—John F. Reed, general manager of Consolidated Ashcroft Hancock Div.

▶ *NATIONAL-U.S. RADIATOR CORP.*—Raymond S. Doherty, builder sales and promotion manager, heating and air conditioning division.

▶ *REYNOLDS METALS CO.*—Robert R. Henningsen, assistant manager, equipment market.

▶ *TRANTER MFG., INC.*—Robert W. Saxton, assistant general sales manager.

▶ *WALWORTH CO.*—Milford H. Luttrell, general sales manager.

▶ *PEERLESS PUMP DIV., FOOD MACHINERY AND CHEMICAL CORP.*—Everett W. Lundy, general sales manager.

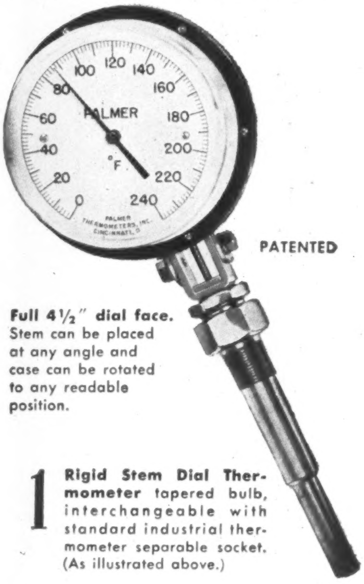
▶ *DETROIT STOKER CO.*—Heinz Pagels, vice president and general manager; Eugene H. Glaettli, secretary and treasurer; Ralph C. Davis, sales manager.

▶ *A. M. BYERS CO.*—Charles P. Hammond, assistant to vice president in charge of operations.

PALMER

MERCURY ACTUATED

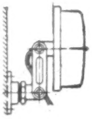
Dial Thermometers now in three types to suit any requirements



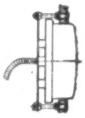
Full 4½" dial face. Stem can be placed at any angle and case can be rotated to any readable position.

1 **Rigid Stem Dial Thermometer** tapered bulb, interchangeable with standard industrial thermometer separable socket. (As illustrated above.)

2 **Wall Mounted Dial Thermometer** with flexible connecting armor. Case adjustable to easy reading position.



3 **Flush Mounted Dial Thermometer** for panel mounting with flexible connecting armor.



All three types have a full 4½" dial face.

for accuracy: Mercury actuated . . . Fully Compensated by Invar Compensaton. Guaranteed Accurate 1 scale division.

for angularity: Can be adjusted to most readable position at any angle desired.

for readability: Bold Black Numbers . . . 11" of scale Reading Dial face can always be placed in easiest readable position.

for interchangeability: Always specify "PALMER" Separable sockets as they are interchangeable for Dial or Industrial type Thermometers.

Write for Catalog information.

PALMER
THERMOMETERS, INC.
Norwood Ave., Cincinnati 12, Ohio
Mfrs. of Industrial Laboratory
Recording and Dial Thermometers

Consulting Engineers: Seelye, Stevenson, Value & Knecht. Heating Contractors: Almirall & Co., Inc. and Norman Heating Co., Inc.; Eugene J. Brandt & Co., Inc.

LARGE TRENCH AT IDLEWILD shows one expansion loop in foreground and another in background. Note large pipes for chilled water lines running outside of the walled trench containing the high temperature hot water system. The control tower is in the center of the photograph, and the new International Arrival Building is at the right of the tower. The bags of GILSULATE are slid down boards into the trench.

$90,000,000 Idlewild expansion program uses 1515 tons of GILSULATE to protect 7 miles of pipe

New York International Airport Has One of World's Largest High Temperature Hot Water Systems

By 1960 "Terminal City" will be a completed reality at New York International Airport. This gigantic undertaking comprises 655 acres and will be equipped to handle 140 aircraft at one time. Estimated cost of the project is $90,000,000.

Running from a central heating plant to each of the projected buildings in Terminal City is one of the world's largest non-military high temperature hot water systems ever designed. This system, operating at 380°F on the supply and 240°F on the return lines, includes 38,774 feet of pipe (7.34 miles!), virtually all of which is protected with 1515 tons of Type B GILSULATE. In this gigantic system, expansion loops alone total almost one mile!

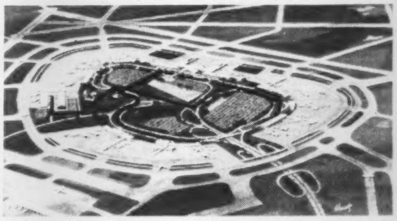
Big job or small job, GILSULATE offers the same unique protection for underground hot pipes—and the same opportunity for on-the-job savings. GILSULATE is easy to install; it calls for no trained fitters or applicators, no special installing equipment. So whether *your* piping job is large or small, you'll find that GILSULATE fits right into your specification picture—at a lower cost per installed linear foot than any other underground hot pipe insulation.

For more complete information, see your local GILSULATE distributor, or write any of our offices listed below.

AMERICAN GILSONITE COMPANY
SALT LAKE CITY 1, UTAH

Affiliate of Barber Oil Corp. & Standard Oil Co. of Cal. OFFICES AT: 134-B West Broadway, Salt Lake City, Utah. The Agents Building, 3537 Lee Road, Cleveland 20, O.

Do you receive PIPE INSULATION NEWS? Ask to be put on our mailing list.



Artist's sketch of Terminal City showing proposed buildings and extent of high temperature hot water system.

FACTS ABOUT GILSULATE

1. **EASY TO USE**—just pour and tamp... pipe heat does the rest.
2. **FORMS 3 ZONES** of protection against heat loss and all hazards commonly encountered by buried hot pipes.
3. **NEEDS NO HOUSING OR MECHANICAL SHEATHS:** no mixing, special handling or equipment.
4. **ONLY NEEDS NORMAL PIPE SPACING:** for multiple pipe or cramped conditions.
5. **THREE TYPES AVAILABLE:**
   Type A for 220°-300°F. temp. range
   Type B for 300°-385°F. temp. range
   Type C for 385°-520°F. temp. range

GILSULATE®

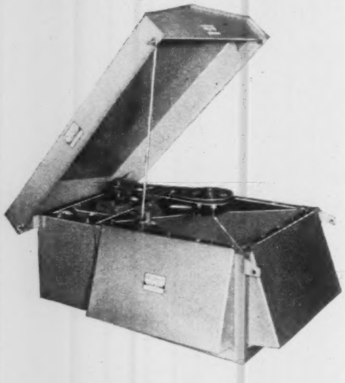
The Triple-Zone Insulation System for Lifetime Protection of Underground Hot Pipes

AirMpeler

LO-BOY

CENTRIFUGAL ROOF EXHAUSTERS

Enchance The Beauty Of Building Skylines



Pats.
Pend.

Lowest Silhouette Design

Forward or Backward Curve Wheel Within . . . . or Out of Scroll Housing

Motor mounting on side of structure support . . . out of line of air stream reduces height of Lo-Boy models nearly 50% of older designs.

LOW WIND RESISTANCE
SIZES 10"-72" 600-47,000
CERTIFIED C.F.M. RATINGS

- **QUALITY** ● **BEAUTY**
- **PROVEN PERFORMANCE**

See Sweet's File 20c/Amm or Write for bulletin HA-100 57

AMMERMAN CO., INC.

110 North Second St.
Minneapolis 1, Minnesota
MEMBER OF THE AIR MOVING & CONDITIONING ASSN.

WHO'S WHAT

Continued

▶ *ALLIS-CHALMERS MFG. CO.*—Henry F. Banzhaf, assistant to general manager of general products division.

▶ *SQUARE D CO.*—Paul R. Shawver, manager of Cedar Rapids, Ia., plant.

▶ *INTERNATIONAL NICKEL CO., INC.*—Dr. Thomas P. May, manager of Kure Beach-Harbor Island testing station on North Carolina coast; Dr. Ralph B. G. Yeo, member of steel research section, Bayonne, N.J.; John B. Adamec, assigned to research staff as metallurgist at Bayonne.

▶ *TEMPRITE PRODUCTS, INC.*—Harold Lance, general manager of Everhot Heater Div.

▶ *REMINGTON AIR CONDITIONING DIV., REMINGTON CORP.*—Walter W. Oman, service manager.

▶ *NATIONAL VALVE AND MFG. CO.*—Roy R. Rothermel, metallurgist.

▶ *BRISK METAL PRODUCTS*—Bill Bray, sales manager.

▶ *HOOKER ELECTROCHEMICAL CO.*—Robert B. Boyd, product manager, organic chemicals; Fred H. Berggren, product manager, chlorate chemicals; Charles Y. Cain, administrative assistant to general sales manager, Durez Plastics Div. Jerome Wilkenfeld, Hooker's assistant technical superintendent, has been appointed to the New York State Air Pollution Control Board.

IN THE TERRITORIES . . .

(Recent sales appointments)

▶ *CARRIER CORP.*—Andrews Distributing Co., Inc., Nashville-Chattanooga area distributor.

ATTENTION MOLINE!

Quad Citian bumps Mr. Entropy* off—stops steam waste with SELECTOTHERM

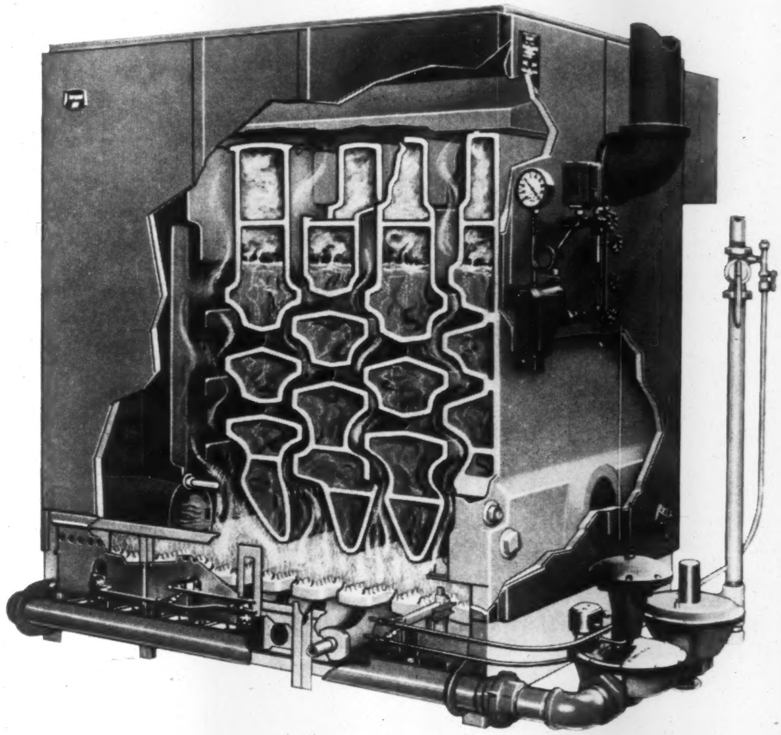
Around Moline, Frank Tyler, 1824 Third Avenue, is well known for getting rid of steam waste in schools and other buildings where boilers are used for steam heating.
He does it with SELECTOTHERM, the high-vacuum heating system that automatically provides steam at the proper pressure and temperature for perfect comfort. Installation records show that SELECTOTHERM cuts the fuel bill 19% or more—*enough to pay for the system within five years!*
SELECTOTHERM applies the control directly to the boiler, adds to the effectiveness of unit ventilators and individual room control. Get the whole story. If you're from the Quad City area, call Frank at American Air Filter Company, Inc., (4-6815). If not, write for fact-filled SELECTOTHERM booklet, *Boiler Room Ballad.*

* *Mr. Entropy represents the heat that is produced but unavailable for use.*

SELECTOTHERM
HEATING CONTROL SYSTEM ®

A product of Illinois Engineering Co.
Division of American Air Filter Co., Inc.
2035 South Racine Ave., Chicago 8, Illinois

Finest in the nation for church, school, industrial or commercial installation!



Bryant Model 630 Boiler

EASIEST TO SELL! The 630 is the owner's assurance of more economical operation, longer life, less servicing, maximum comfort.

EASIEST TO INSTALL! Installing Bryant means more money in your pocket—because you save on time, labor, and materials.

PROBLEMS? Trained experts at the factory and field levels are available to assist you with installation or application problems.

RUSHED FOR TIME? Bryant offers you IMMEDIATE DELIVERY.

AND REMEMBER—Bryant is rated FIRST by leading utilities, architects, and engineers everywhere.

In addition to the 630, the Bryant 26, 225, and 446 models round out the most complete line of gas fired boilers in the industry.

For further information contact your nearest Bryant distributor or write us directly. We'll be glad to furnish you more details.

50th
ANNIVERSARY
1907 - 1957

50 YEARS OF ENGINEERING SKILL, RESEARCH AND DEVELOPMENT ARE PACKED INTO THE 630

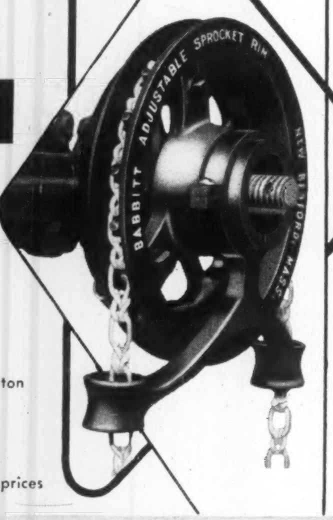
bryant

© 1957, Bryant Manufacturing Company, Indianapolis, Indiana · Bryant Manufacturing, Ltd., Toronto, Canada

Insurance Can't Prevent Accidents—
A Babbitt SPROCKET RIM CAN!

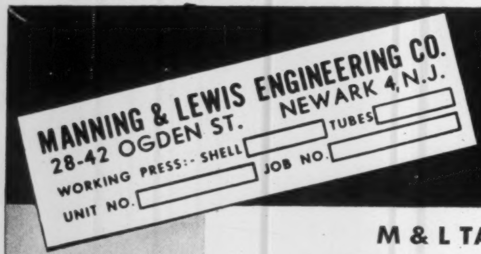
Babbitt

Adjustable
SPROCKET RIM
with Chain Guide



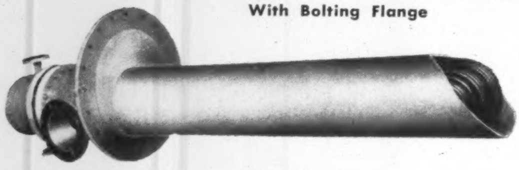
- Simplifies pipe layout
- Fits any size valve wheel
- Easy to install and operate
- Operates any valve from plant floor
- Time and money saving fixture
- No maintenance, first cost only cost
- Packed, completely assembled, one to a carton
- Hot galvanized, rust-proof chain available for all sizes
- Easy to follow instructions with each unit
- Your supplier carries complete stocks
- Write for new descriptive catalog sheet and prices

Babbitt STEAM SPECIALTY CO.
8 BABBITT SQUARE, NEW BEDFORD, MASS., U.S.A.


MANNING & LEWIS ENGINEERING CO.
28-42 OGDEN ST. NEWARK 4, N.J.
WORKING PRESS:- SHELL
TUBES
UNIT NO.
JOB NO.

FUEL OIL HEATERS WATER HEATERS and COOLERS

M & L TANK OUTLET HEATERS
With Bolting Flange



THIS NAMEPLATE IS YOUR GUARANTEE OF QUALITY

•

Heat Exchangers
Condensate Coolers
Heating Elements
Converters
Tank Heaters
Tankless Water Heaters
Instantaneous Water Heaters

FUNCTION: Installed in bulk storage tanks to prewarm viscous liquids (fuel oil, tar, road oil, molasses, lubricating oil or asphalt) that have been exposed to low temperatures.

CONSTRUCTION: Heads available in either cast iron or steel. Tubes of heavy gauge steel. Tube sheets and baffles of steel.

HEATING MEDIUM: Steam or hot water.

SPECIAL FEATURES: Economical to operate . . only the liquid that is being withdrawn is heated. Special baffling assures greater efficiency. Can be bolted directly to nozzle. Special swing valve, as optional equipment, permits closing off the shell of suction heaters to enable removal of heads without emptying tank. (not illustrated).

For further details send for your copy of Bulletin #743.

Manning & Lewis *Engineering Company*
DESIGNERS & MANUFACTURERS OF QUALITY HEAT EXCHANGE EQUIPMENT
28-42 OGDEN STREET NEWARK 4, NEW JERSEY

M&L

WHO'S WHAT

Continued

▶ *POWERS REGULATOR CO.*—Howard L. Lundvall, New York district manager; Alvin H. Moraweck, Jr., Springfield, N.J., branch manager; John Lee, manager of new factory branch office in Salt Lake City; K. F. Tirsell, manager of enlarged Indianapolis office.

▶ *WORTHINGTON CORP.*—A. E. Borden Co., packaged air conditioning equipment wholesaler for Maine, New Hampshire, Rhode Island, eastern Massachusetts.

▶ *TUTHILL PUMP CO.*—Marrick Co., Inc., representative for Kentucky, southern Indiana.

▶ *WOLVERINE TUBE, DIV. OF CALUMET & HECLA, INC.*—Frank H. Grace and Co., manager of new mill depot facilities in Cleveland. The Grace company is Cleveland agent for Wolverine Tube.

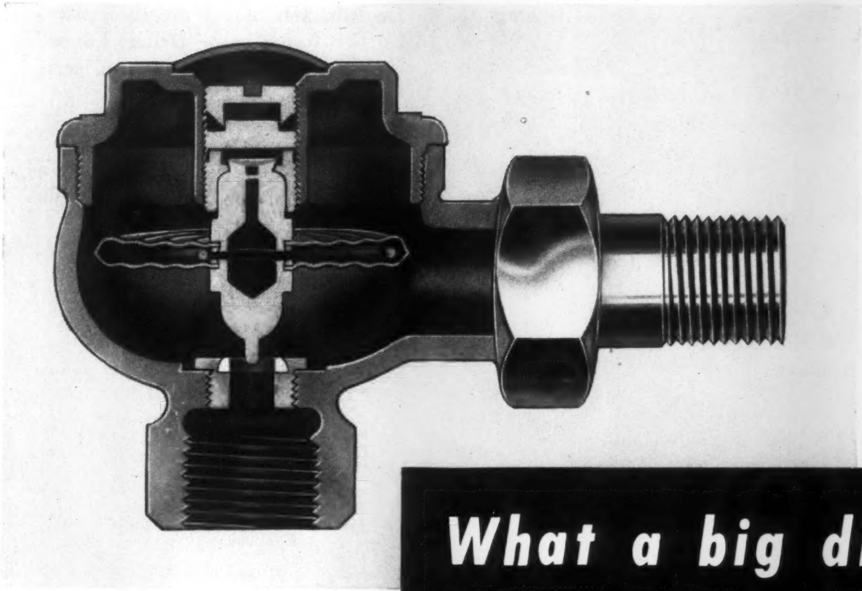
▶ *AMERICAN-STANDARD PLUMBING AND HEATING DIV.*—Henry C. Pierce, manager of midwestern sales district with headquarters in Kansas City, Mo.; James W. Hart, manager of Dallas sales office.

▶ *TRANE CO.*—Joseph Rohats, manager of Phoenix branch office; Robert Knowles, Greenville, S. C., office manager; Robert A. Huff, service engineer, Cincinnati regional office.

▶ *DUNHAM-BUSH, INC.*—John J. Castello and Delton E. Harper, sales engineers for Los Angeles and Houston areas, respectively.

▶ *RECOLD CORP.*—Charles W. Hanson, refrigeration and air conditioning representative for Florida.

▶ *VILTER MFG. CO.*—Francis Pallanch, district manager of Minneapolis office.



We'll be there . . . at the 10th Exposition of Air Conditioning and Refrigeration

Booth No. 201

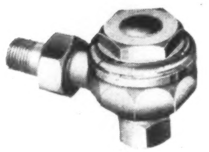
International Amphitheater • Chicago
November 18-21, 1957

. . . AND we'll provide FREE BUS SERVICE to and from the show at

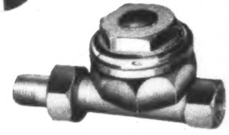
HOTEL SHERMAN • MORRISON HOTEL
PALMER HOUSE • CONRAD HILTON

Be our guest!

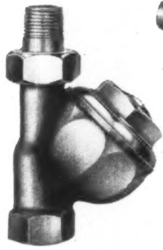
What a big difference a trap can make!



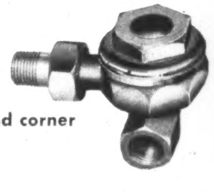
Angle



Straightway



Vertical



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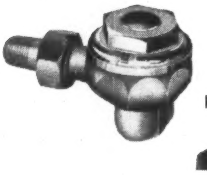
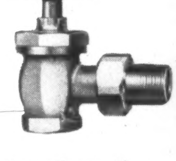


Right hand corner



Marsh Packless Radiator Valves are perfect team mates for Marsh Radiator Traps. The metal-to-metal seal places them in a class all their own.

Yes, the success or failure of a steam distribution system can hinge on things as small as radiator traps. That's why it pays to use Marsh Radiator Traps—traps that are individually and permanently adjusted to close tight on steam, but open promptly and pass air or condensate at temperatures only a few degrees below closing temperature.

The part that provides positive operation in Marsh Radiator Traps is that rugged-but-sensitive thermostatic diaphragm. After this element has been assembled it is made completely seamless by a heavy overall deposit of copper. It is then filled with an accurately measured charge of volatile fluid; finally tested by expert operators to make sure that its expansion and contraction is exactly right to produce the utmost efficiency and economy.

Construction throughout is in keeping with the effective diaphragm. Bodies are of extra heavy cast brass suitable for pressures up to 125 lbs. steam. Bonnet assemblies of a given type and size are interchangeable. Trap seats are renewable. All components are made with a large safety factor beyond rated operating pressures.

Next time make it Marsh throughout and see the difference . . . Marsh traps, packless valves, bucket traps, venting valves. All are covered in the new fact-filled catalog.

MARSH INSTRUMENT CO. *Sales Affiliate of Jas. P. Marsh Corporation* **Dept. T, Skokie, Ill.**
Marsh Instrument & Valve Co. (Canada) Ltd., 8407 103rd St., Edmonton, Alberta

MARSH

Heating Specialties **SINCE 1865**

WHO'S WHAT

Continued

▶ *LIMA REGISTER CO.*—Joseph C. Hanger, district manager for Ohio, Indiana, Michigan, Kentucky, West Virginia.

▶ *MARLO COIL CO.*—P & E Sales Assoc., representative in northern New Jersey, seven suburban counties of New York.

▶ *ELLIOTT CO., DIV. OF CARRIER CORP.*—H. J. Campbell, Kansas City district manager.

▶ *PEERLESS ELECTRIC CO.*—Norman S. Wright and Co., western sales representative for fan and blower division.

▶ *WESTINGHOUSE ELECTRIC CORP.*—For air conditioning division: Robert E. Haubold, southwestern regional sales manager; A. L. McDonald, Jr., western regional sales manager.

▶ *KENNEDY VALVE MFG. CO.*—Gene Reinersman, to headquarter in Covington, Ky., with territory of Kentucky, southern Indiana; W. F. Strickland, to headquarter in Decatur, Ga., and serve the Atlanta area; A. E. Hockaday, to work out of Dallas; Edward Shortall, to headquarter in San Francisco and serve that area.

▶ *ACME INDUSTRIES, INC.*—William J. Brinkmann and Thomas O. Blackmon, sales engineers for Houston regional office.

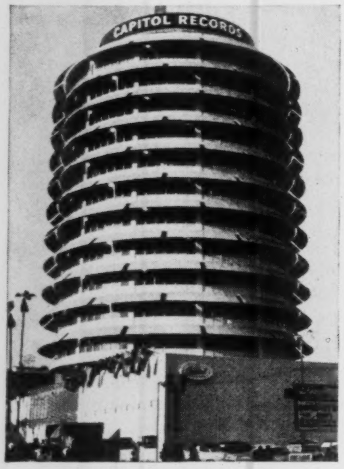
▶ *A. M. BYERS CO.*—William J. Kelly, manager of Washington, D.C., division.

▶ *ARMSTRONG CORK CO.*—John J. Roper, district manager of insulation division's Boston office.

▶ *LESLIE CO.*—Roy D. Kelley, district sales manager for southeastern United States.

▶ *JOHN WOOD CO.*—Don Gibson, Cleveland district sales representative for Heater & Tank Div.

▶ *AUTOMATIC SWITCH CO.*—Stocking distributors of "Asco" solenoid valves are: John N. Fehlinger Co., Inc., New York City; Leighton Stone Corp., San Francisco; Western Machinery Co., Portland, Ore.



CAPITOL RECORDS BLDG.
LOS ANGELES, CAL.

WELTON, BECKET & ASSOCIATES, ARCHITECTS-ENGINEERS, STATE PLUMBING & HEATING CO., MECHANICAL CONTRACTOR

Capitalize on

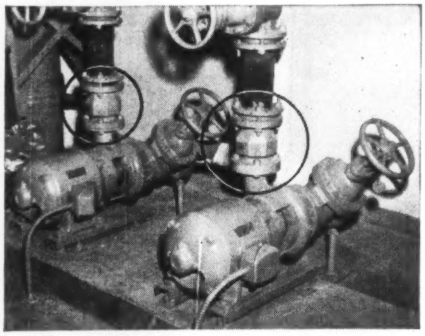
MILLER Streamflow CHECK VALVES

Completely Silences your piping system! CENTER-GUIDED, SHOCK PROOF, NOISELESS, ELIMINATES WATER HAMMER. FULL RADIAL FLOW.

SIZES 1" THROUGH 24".

FLANGED, ASA DRILLING, IBBM, CAST STEEL, ALL ALLOYS. FOR ALL FLUIDS AND GASES.

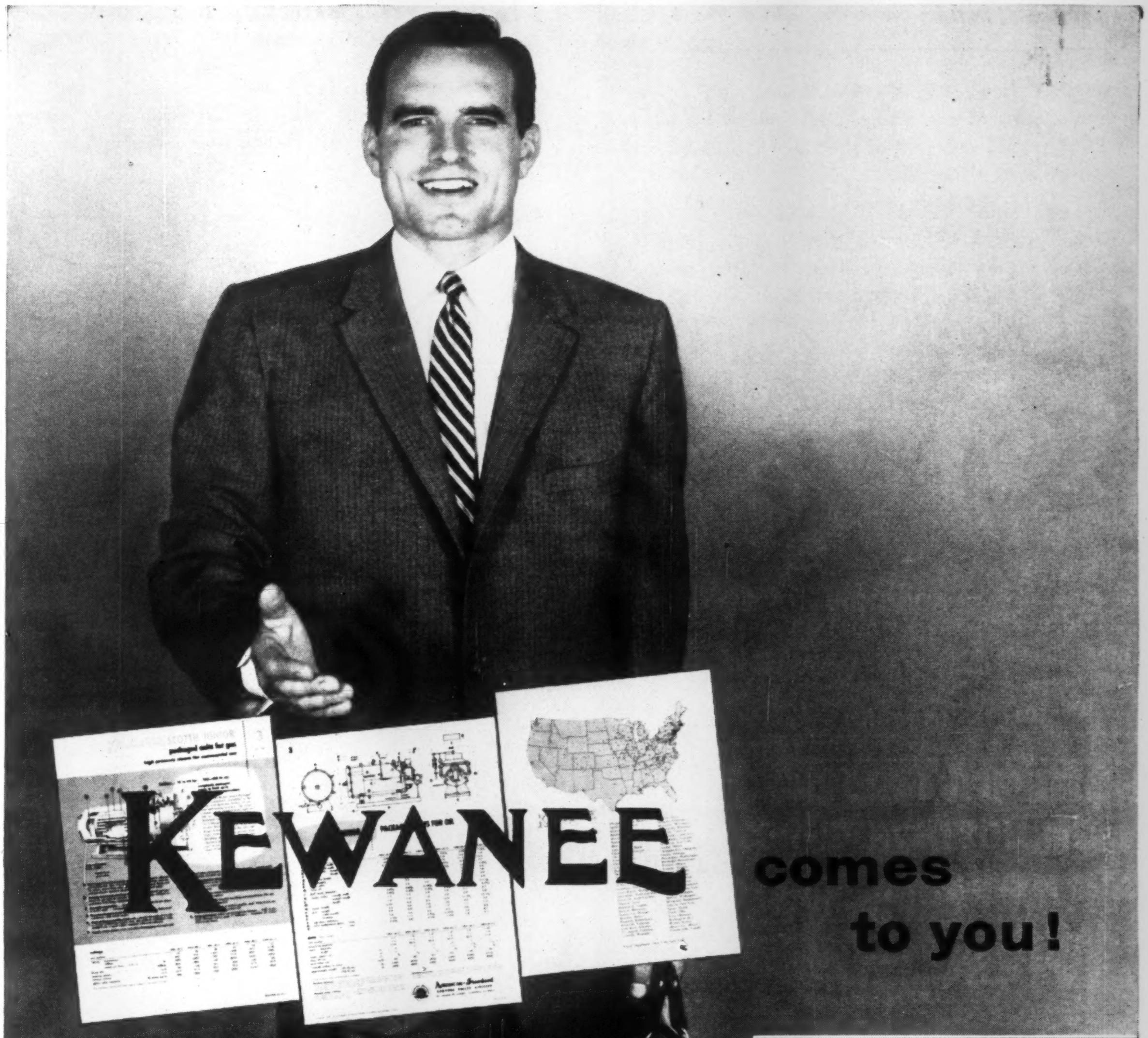
CERTIFIED MINIMUM PRESSURE DROP CURVE AVAILABLE



Write for literature • Agents in Principal Cities

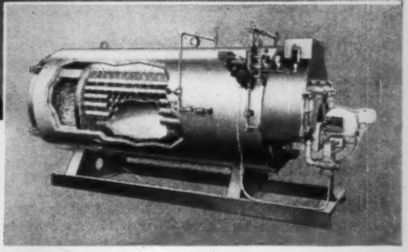
MILLER VALVE CO., INC.

P.O. Box 1255—Pittsburgh 30, Pa. Plant—1620 Pennsylvania Ave.



Face-to-face with your Kewanee Man, you can explain exactly what you want to know. And he's able to give your boiler problems his personal attention, because there are *enough* Kewanee representatives to let each man do his job right! Actually, over 300 trained Kewanee Men operate from a network of 69 offices in 48 states—well able to regularly visit smaller towns as well as metropolitan centers.

Your Kewanee Man, for example, keeps up-to-date your catalog of Kewanee's complete line of fire-tube steel boilers to 651 h.p. These are the boilers with famous "cruising speed" operation . . . the boilers with an 89-year record of dependability, ease of maintenance and low operating cost. AMERICAN-STANDARD, KEWANEE BOILER DIVISION, 101 Franklin Street, Kewanee, Illinois



Ideal for laundry, cannery, dairy or other small plant, the Kewanee Scottie Junior Package is available in six sizes for oil or gas . . . 18 to 65 h.p., 125-150 lb. wp.

AMERICAN-Standard

KEWANEE BOILER DIVISION

Quality protects your investment—
AMERICAN-Standard
quality is available at no extra cost.

WHO'S WHAT

Continued

▶ *JOSEPH T. RYERSON & SON, INC.*—Clive C. Earle, sales manager for Buffalo plant; Frederick B. Winther, Jr., manager of sheet and strip sales at Cincinnati steel service plant.

▶ *PENNSYLVANIA SALT MFG. CO.*—John D. B. Gould, representative for "Isotron" refrigerants, Chicago.

▶ *SOLAR AIRCRAFT CO.*—Allied Supply Co., distributor for 10 southernmost California counties, Clark County, Arizona.

▶ *EUTECTIC WELDING ALLOYS CORP.*—John E. Jackson, regional manager to train and coordinate activities of group of district engineers.

▶ *PENN CONTROLS, INC.*—C. Philip Pestow, manager of Philadelphia district office; William P. Marshall, sales engineer in Dallas district.

▶ *MADDEN BRASS PRODUCTS CO.*—J. A. Dorman, representative for New York City area.

▶ *MITCHELL MFG. CO.*—Dallman Co., distributor for northern California trading area.

▶ *RUUD MFG. CO.*—Richard T. Madden, western Pennsylvania district representative.

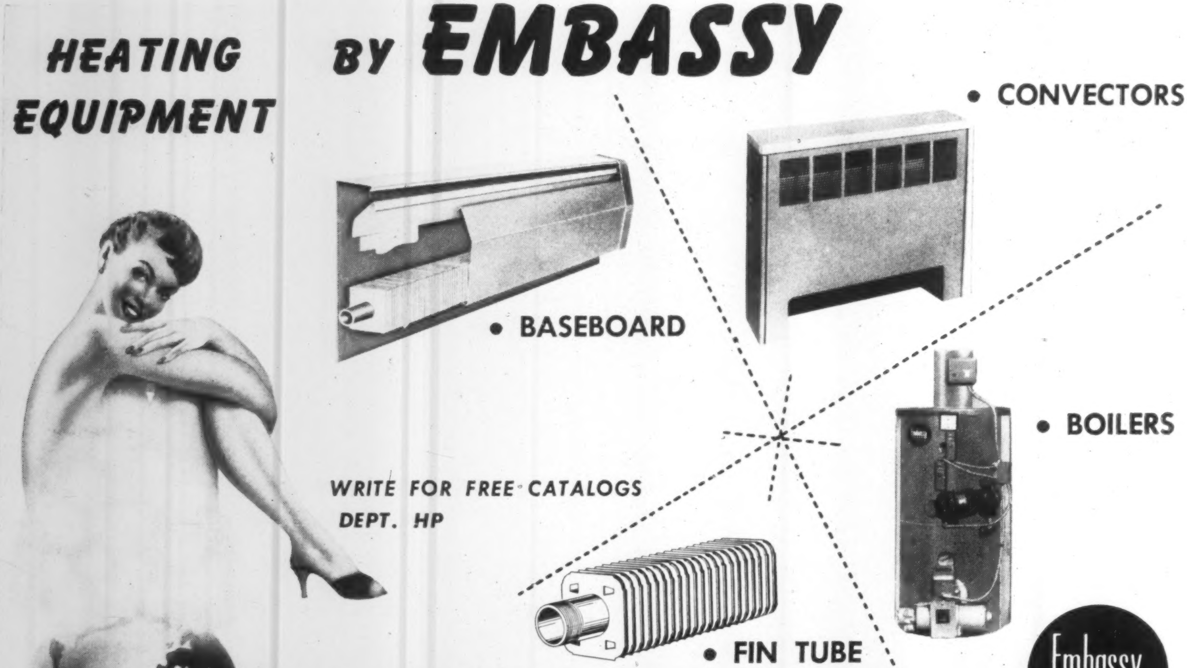
▶ *FRASER & JOHNSTON CO.*—Sidles Co., distributor for Nebraska, western two-thirds of Iowa.

▶ *BRISTOL CO.*—E. A. Merwin, manager of new branch factory and repair laboratory in Houston.

▶ *ARMSTRONG FURNACE CO.*—Robert G. Watkins, district manager, Michigan.

▶ *ROBERTSHAW FULTON CONTROLS CO.*—Gibson B. Mead, assigned to sales engineering staff of Camden, N.J., office of Fulton Sylphon Div.

▶ *HOOKER ELECTROCHEMICAL CO.*—Oldbury products sales representatives reassigned to Hooker sales districts are: Joseph I. Rue, Chicago; John W. Johnstone, Jr., Niagara Falls; Charles H. Foster, Jr., Philadelphia; James T. Whelen, New York.


HEATING EQUIPMENT BY EMBASSY

• CONVECTORS

• BASEBOARD

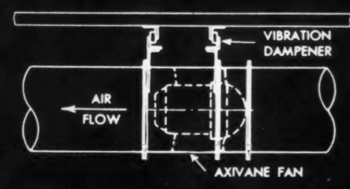
• BOILERS

• FIN TUBE

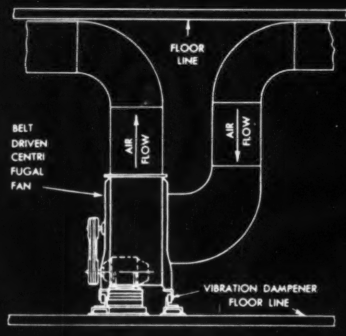
WRITE FOR FREE CATALOGS
DEPT. HP

EMBASSY STEEL PRODUCTS, INC.
890 STANLEY AVE. • BROOKLYN 8, N. Y.

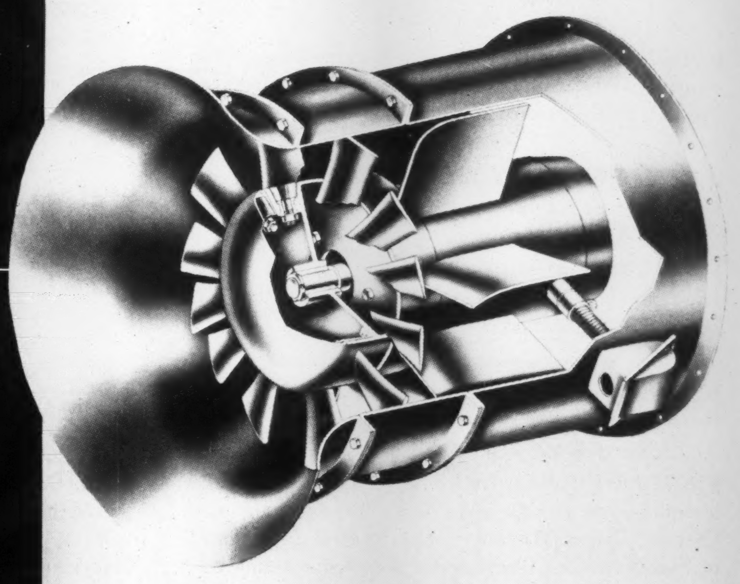
IT'S EASIER TO INSTALL A JOY FAN


VIBRATION DAMPENER
AIR FLOW
AXIVANE FAN

JOY AXIVANE FAN


FLOOR LINE
BELT DRIVEN CENTRI FUGAL FAN
AIR FLOW
AIR FLOW
VIBRATION DAMPENER
FLOOR LINE

OLD STYLE FANS



JOY FANS SAVE SPACE

simplify engineering and installation

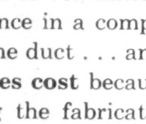
When you install a Joy fan you install a simpler system of ventilation. The Joy fan offers high performance in a compact package. The fan fits right into the duct . . . and the motor is inside the fan.

Saves cost because the installation can be made during the fabrication of the duct system. **Saves cost** because the installation can be made by relatively unskilled labor. **Saves cost** because the duct system is simpler . . . no offsets or elbows.

Saves cost because it turns valuable space over for rental or use (value averaging $5.00 per sq. ft. per month).

Study the drawings above. Notice the efficiency and compactness of the Joy fan compared to other systems . . . then call in a Joy engineer. ***Joy Manufacturing Company, Oliver Building, Pittsburgh 22, Pa.*** In Canada: *Joy Manufacturing Company* (*Canada*) *Limited, Galt, Ontario.*

WSW I 6828-199



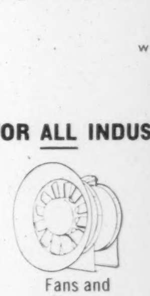
WRITE FOR
FREE BULLETIN
199-41

JOY... EQUIPMENT FOR INDUSTRIAL PLANTS... FOR ALL INDUSTRY

Industrial Compressors

Conveyors

Electrical Connectors



Fans and Blowers

WHO'S WHAT

Continued

▶ *ELECTRIC FURNACE-MAN, INC.*—John R. Cooke, district manager to cover New York City, Long Island, Rockland and Westchester, New York Counties, northern New Jersey, Fairfield County, Conn.

▶ *JOHN WOOD CO.*—John Q. Woodruff, agent for company's heater and tank division in Utah, Montana, Nevada, Idaho, western Wyoming.

▶ *HEIL CO.*—Heckler Bros., distributor for southwestern Pennsylvania.

▶ *NATIONAL SUPPLY CO.*—Lawrence R. Sullivan, Jr., representative in Boston office of Spang-Chalfant Div.

▶ *SIMPSON ELECTRIC CO.*—John F. Schipitz and Robert Vandervoort, appointed to sales staff.

▶ *HAMER VALVES, INC.*—New representatives and territories they will serve are: Henry Kalz Co., Oregon; Barber Machinery, Ltd., Canadian provinces of Saskatchewan, Alberta, part of British Columbia.

▶ *PHILIP CAREY MFG. CO.*—Assuming new sales responsibilities are: J. A. Rousmaniere, for Boston, Washington, Atlanta, Houston division territories; R. C. Bressan, for Detroit, Chicago, Milwaukee, St. Louis, Kansas City division territories.

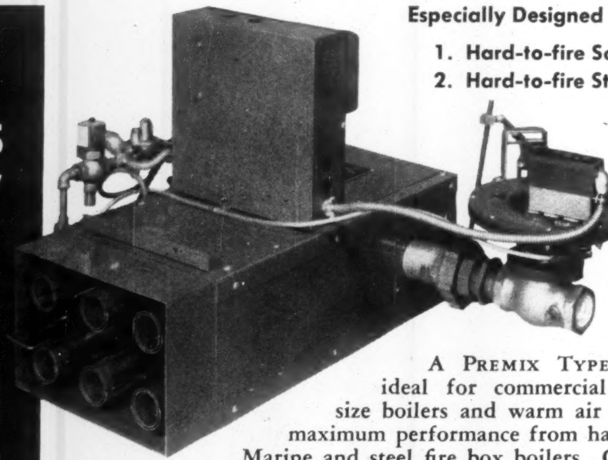
▶ *NIAGARA MACHINE & TOOL WORKS*—Robert F. Gaylord, manager of new Boston district office at Waltham, Mass.; Noland Co., Inc., distributor for Georgia, Tennessee.

▶ *MUELLER BRASS CO.*—William R. Carson and Charles L. Treend, representatives assigned to Washington, D.C., and Dallas offices, respectively.

▶ *LESLIE CO.*—George L. Simonds Co., Florida agent for regulators and controllers.

▶ *PERMAGLAS DIV., A. O. SMITH CORP.*—James Van Buskirk, assigned to northern California area.

▶ *AUTOMATIC SWITCH CO.*—Sidney Dubinsky has moved his office to 1605 Court Square Bldg., Baltimore 2. Mr. Dubinsky is Asco's representative for Maryland.



Especially Engineered to Permit . . .

HIGH FIRING RATES at HIGH EFFICIENCY

MULTURI (MULTIPLE VENTURI) BURNERS

- Formed steel mixers, finished for corrosion resistance, offer minimum resistance to mixture flow, result in uniform high capacity.
- High temperature resisting stainless steel flame retainers insure flame stability over a wide capacity range.
- Mixer design produces a hot clear flame, results in high combustion efficiency with minimum excess air.

Especially Designed for . . .

1. **Hard-to-fire Scotch Marine Boilers**
2. **Hard-to-fire Steel Fire Box Boilers**

Multuri Burners available in standard units, 4 to 54 mixers. Capacities 700,000 to 10,800,000 BTU/hr. Higher capacities can be furnished.

A PREMIX TYPE GAS BURNER, ideal for commercial and industrial size boilers and warm air furnaces. Gives maximum performance from hard-to-fire Scotch Marine and steel fire box boilers. Controlled flame characteristics make the burner a natural for units with extensive refractory surface. Suitable for any gas at 4" gas pressure or more. Permits high firing rates at high efficiency. Simple to install, adjust, and operate. Completely Factory Wired and Assembled — Ready for Immediate Installation !

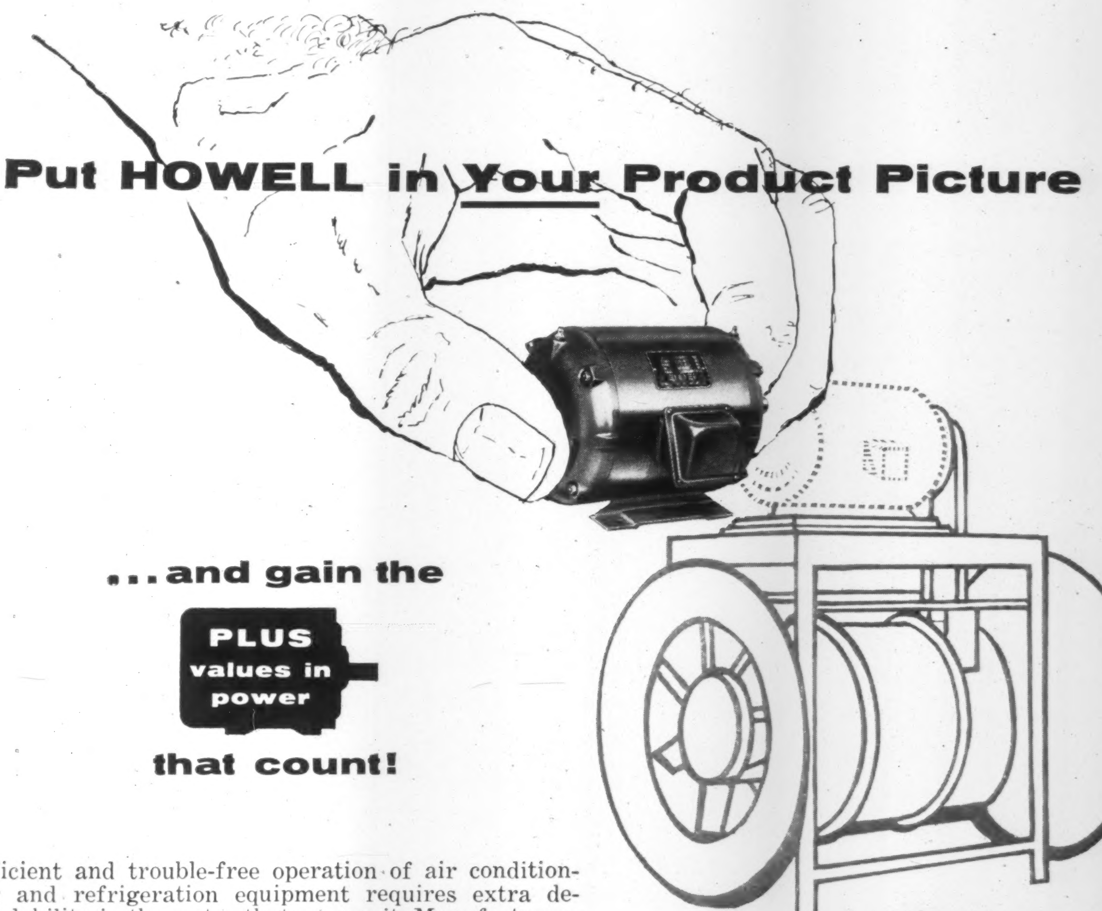
Write for detailed information—or for a questionaire listing all the data necessary for correct specifications and efficient installation.

GORDON BYDAMP
GAS HEATING EQUIPMENT

ROBERTS-GORDON
DEPT. HPAC BUFFALO 6, N. Y.

FURNACES • COOLING UNITS • BOILERS • UNIT HEATERS • GAS BURNERS

Put HOWELL in Your Product Picture



. . . and gain the

PLUS values in power

that count!

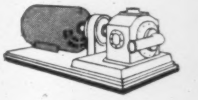
Efficient and trouble-free operation of air conditioning and refrigeration equipment requires extra dependability in the motor that powers it. Manufacturers and users throughout the industry recognize the plus values gained by specifying Howell motors, 1/8 thru 300 hp. Here are a few of these values:

Steel Feet and Frames Won't Crack Under Stress Unlike cast iron, Howell's steel feet won't crack when mounting bolts are tightened excessively. Howell's cold-rolled steel frames can take installation punishment. Cast iron end-plates assure constant shaft and bearing alignment.

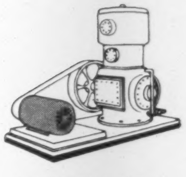
Cool-Running, Long-Lasting Efficiency New stator design with wide slots provides 50% more contact between cooling air and stator laminations. Combined with heat-dissipating copper rotors, this gives you a motor with extra stamina to withstand intermittent overloading or unusually high operating temperatures.

Functional Streamlining Howell motors have no fins, ribs or unnecessary offsets to collect dust deposits. External dirt cannot reduce these motors' cool-running efficiency — their neat appearance is easier to maintain.

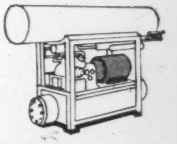
Wide Selection Howell makes virtually every type of AC industrial motor . . . fractional and integral to 300 hp, in all standard enclosures, in rerated and non-rerated frame sizes, and in many pump mountings. Howell part winding motors, for reduced voltage starting of compressors, pumps, etc., may be of special interest to you.



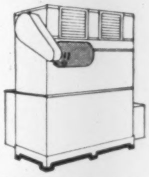
PUMPS



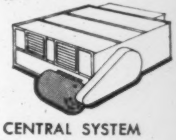
COMPRESSORS



PACKAGED CHILLERS



COOLING TOWERS



CENTRAL SYSTEM CONDITIONERS

Howell motors are used by these leading manufacturers of air conditioning equipment:

York Corp. ● Acme Industries ● Worthington Corp. ● Frick Corp. ● The Trane Co.

Binks Manufacturing Co. ● American Blower Corp.

A Howell sales engineer can give you valuable assistance on any motor application. Wire or 'phone collect . . . or drop us a line . . . you'll get prompt action. Howell Electric Motors Co., Howell, Michigan.

HOWELL Red Band MOTORS

HOWELL *motors*

. . . precision built for industry since 1915

Cool as a Cumulus
SHREVEPORTER
HOTEL
SWIMMING POOL
DINING TERRACE
Quiet Beyond Belief!
d-h AIR CONDITIONING

Says: Jack Tullos, President-Manager of the eye-filling new Shreveporter Highway Hotel . . .

- "Quite a saving in initial and operating costs!"
- "Periodic filter change our only maintenance."

Drayer-Hanson can cite similar case histories, world-wide: big jobs or small; new or old construction; residential, commercial, industrial . . .

Request SPOTAIRE literature

d-h SINCE 1910

drayer-hanson
DIVISION OF NATIONAL-U S RADIATOR CORP
3301 MEDFORD STREET
LOS ANGELES 63, CALIFORNIA
CABLE FORTRADE

WHO'S WHAT

Continued

▶ *BLACK & DECKER MFG. CO.*—John T. Tierney, branch service manager of new factory service and sales branch in Hartford, Conn.

▶ *GORTON HEATING CORP.*—Hardesty-Favero, Inc., representative for Washington, Oregon, Idaho, Utah, British Columbia.

▶ *JOSEPH T. RYERSON & SON, INC.*—Robert Kreml, sales agent for Arizona.

▶ *MITCHELL MFG. CO., DIV. OF CORY CORP.*—Wayne Gift, district manager for Indiana.

▶ *RUUD MFG. CO.*—H. R. Basford Co., distributor for Oregon, Washington, parts of Montana and Idaho.

▶ *ALLMETAL SCREW PRODUCTS CO., INC.*—Tom Schaid, head of new midwest division headquarters in Chicago. The office will handle sales activities for Illinois, Indiana, Iowa, Minnesota, Missouri, the Dakotas, Wisconsin.

▶ *BRISTOL CO.*—Lyle R. Koroch, sales engineer in charge of new office in Portland, Ore.

▶ *CLAYTON MARK & CO.*—Joseph S. Mikovich, union sales representative for Pennsylvania, western New York, eastern Ohio, Toronto.

▶ *ZONOLITE CO.*—Gunite Concrete and Construction Co., authorized applicators for "Blo-Crete" industrial fireproofing, encasement, and protective coating systems in Kansas City area.

▶ *TRION, INC.*—Norman S. Wright and Co., representative for Phoenix area.

▶ *HOOKER ELECTROCHEMICAL CO.*—Neil M. Barber and John J. Wojnar, sales manager and office manager, respectively, for new district sales office in Philadelphia. The office will serve Pennsylvania, southern New Jersey, eastern West Virginia, all states east of the Mississippi River and south of Kentucky.

▶ *ELECTRONICS CORP. OF AMERICA*—R. E. Kittoe, area manager of new Charlotte, N.C., office for combustion controls division. ⫩

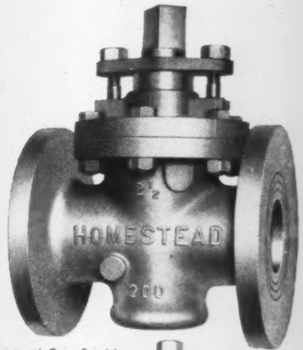
Multiple Port,
100% Pipe Area
or Venturi

HOMESTEAD

offers you one source for

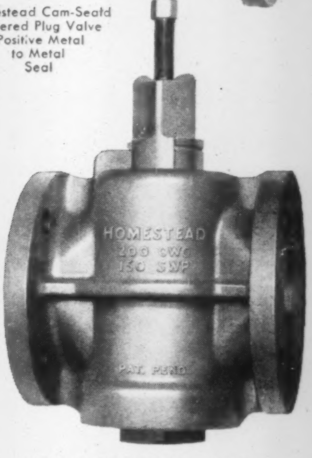
ALL TYPES OF PLUG VALVES

ALL TYPES OF PORT OPENINGS

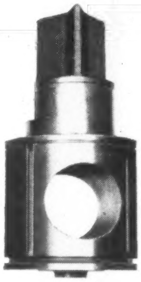


Homestead Cam-Seald
Tapered Plug Valve
Positive Metal
to Metal
Seal

Diamond Port
or "V" Port
for Throttling



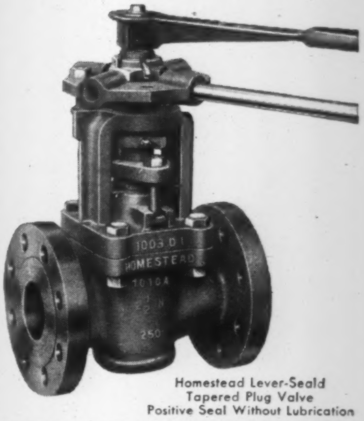
Homestead Lubricated Plug Valve
High Pressure Chemical Seal



Round Port
100% Pipe Area

Name the type of valve you need in the metal or alloy you require with the port opening you want—and we can furnish it. Or if you have a valve problem that defies solution, write us, naming the fluid, concentration, temperature, pressure, valve size, function and frequency of operation. We will be happy to recommend the best and most economical valve for your service conditions.

For complete information on Homestead Plug Valves



Homestead Lever-Seald
Tapered Plug Valve
Positive Seal Without Lubrication

Rectangular Port
100% Pipe Area

MAIL THE COUPON NOW!

Please send me information on the following Homestead Plug Valves:

☐ Lubricated ☐ Lever-Seald ☐ Cam-Seald

Name__________ Title__________

Company__________

Address__________

City__________ State__________

Rectangular Port
Venturi

HOMESTEAD VALVE MANUFACTURING COMPANY

P.O. Box 128 *"Serving Since 1892"* Coraopolis, Pa.

WE HEAR THAT...

▶ Stockholders of *CARRIER CORP.* and *ELLIOTT CO.* have approved merger terms whereby Elliott has become a division of Carrier. Continuing as president of the Elliott division, *WILLIAM A. ELLIOTT* is now a vice president and director of Carrier, and *LAWRENCE M. FORNCROOK*, who has served on the Elliott board for many years, also has become a Carrier director.

▶ The formation of the Radiant Heating and Cooling Institute has been announced by *GEORGE RUSHER*, president of the group. With a membership composed of radiant heating contractors and engineers, the Institute will offer information and assistance to architects, builders and affiliated groups in the construction field.

▶ *RELIANCE ELECTRIC & ENGINEERING CO.* and *MASTER ELECTRIC CO.* have jointly announced that the combination of the companies has received shareholder approval. The consolidation will be effected by the exchange of Reliance stock for the assets of Master. Master will be operated as a division of Reliance under supervision of the present management.

▶ *L. J. WING MFG. CO.* has sold its assets to *AERO SUPPLY MFG. CO., INC.*, Corry, Pa. Wing will be known as *L. J. WING MFG. CO., DIV. OF AERO SUPPLY MFG. CO., INC.*, and will operate as an independent division. It will continue to manufacture its present products at its Linden, N. J. location. *H. S. WHELLER* has been named chairman of the division and *JAMES L. SPENCER*, a director of Aero Supply, will be president.

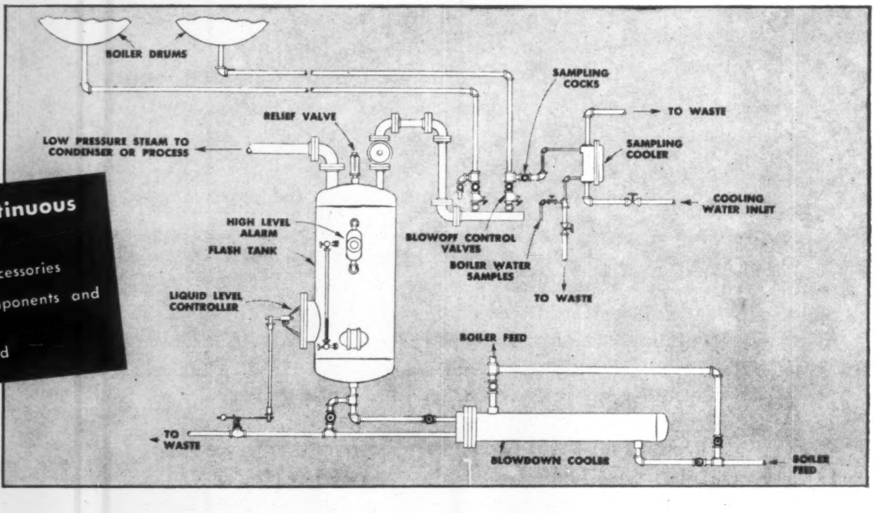
▶ At a cost of over $700,000, *TRANE CO.* is doubling in size its research and testing facilities, "The House of Weather Magic." Trane plans to add 35,000 sq ft of test area to the structure.

▶ *MILTON ROY CO.* has purchased *ANDERS-LYKENS CO.*, Lykens, Pa., manufacturer of instrument air dryers and gas dehydrators. With the approval of the Milton Roy board of directors, *ROBERT T. SHEEN*, president, completed negotiations resulting the formation of the *ANDERS DIV. OF MILTON ROY CO.*

▶ *FISHER GOVERNOR CO.* has agreed to exchange common stock for the assets of *CONTINENTAL EQUIPMENT CO.*, Coraopolis, Pa. The agreement is subject to approval by Continental stockholders.

Maintain Proper Boiler Water Concentrations —

FOR ECONOMICAL BOILER OPERATION



Standard WHITLOCK Continuous Blowdown System

ECONOMICAL: standard low cost accessories

COMPLETE: with all operating components and controls carefully selected

AUTOMATIC: no attendance required

This Continuous Blowdown System automatically provides effective, low-cost boiler protection. Ask us to recommend a unit engineered for your plant.

Whitlock

THE WHITLOCK MANUFACTURING COMPANY
44 SOUTH STREET • WEST HARTFORD 10, CONN.
New York • Boston • Chicago • Philadelphia • Detroit • Richmond
Authorized representatives in other principal cities
In Canada: Darling Brothers, Ltd., Montreal

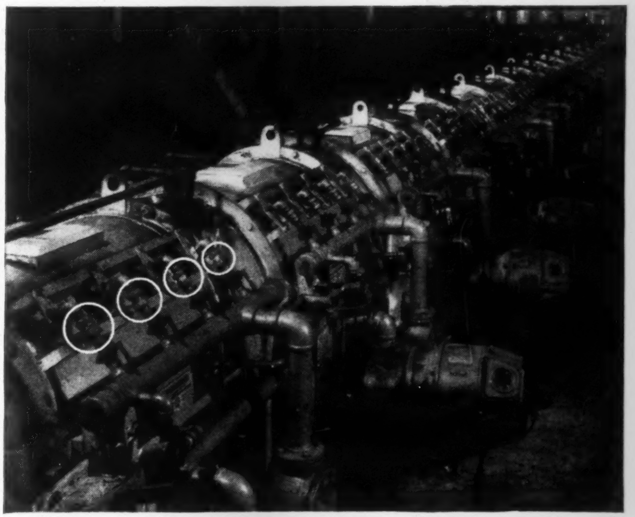
Designers and builders of bends, coils, condensers, coolers, heat exchangers, heaters, piping, pressure vessels, receivers, reboilers.

Tough jobs are a "cinch" for DRESSER Couplings

1

For Rapid Takedowns

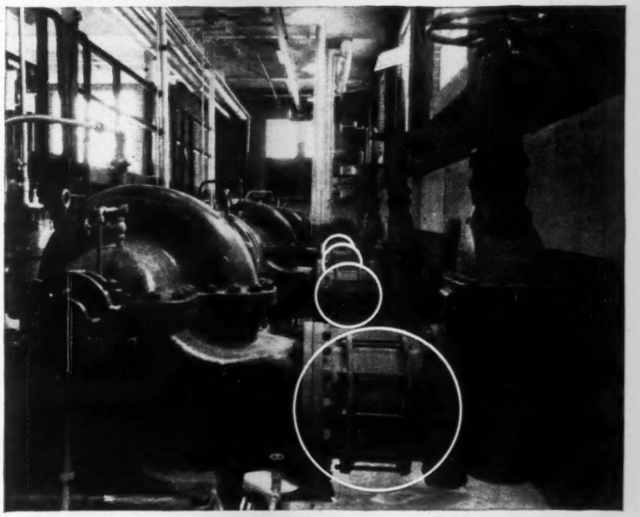
When piping on this huge industrial furnace manifold is removed for periodic cleaning of burners, down time is cut to a minimum. A few turns of a wrench disengages each of the over 100 Dresser Style 65 Couplings. They are easily reinstalled.



2

For Absorbing Vibration

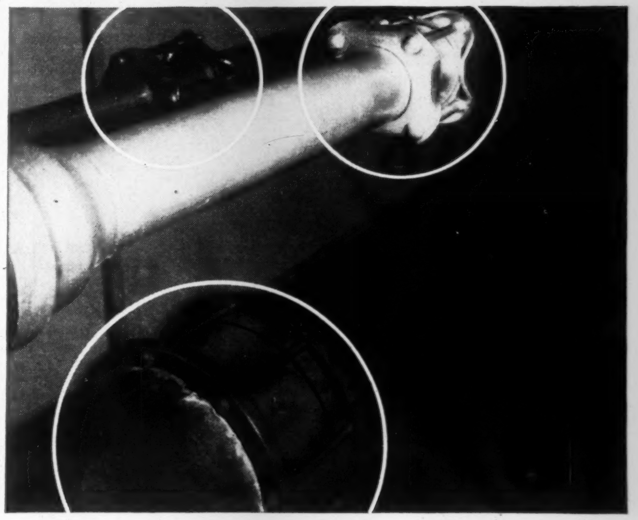
No matter how much these pumps vibrate, the Dresser Style 38 Couplings stay permanently tight. They're equipped with Dresser gaskets which absorb vibration, reduce noise. Style 38's are available for plain-end steel, cast iron or other pipe. Wrench-installed in but two man-minutes per bolt.



3

For Give-and-Take Flexing

At expansion joints in walls, anchored lines carrying liquids or gases must have joints that will *absorb* pipe movements. So Dresser Style 38 Couplings are used. They have resilient rubber gaskets that absorb expansion-contraction, yet stay bottle-tight and maintenance-free.

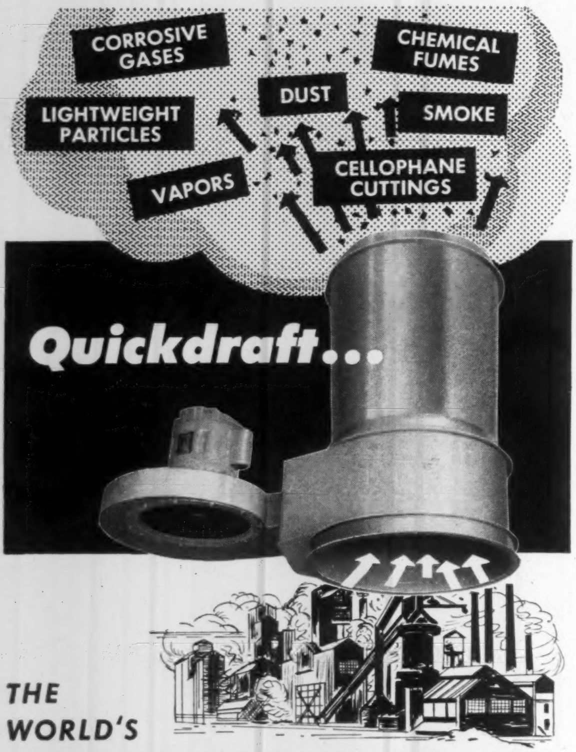


For fast, easy, sure pipe joining, see your local piping supplier for Dresser Couplings, Ells, Tees, Adapters, etc.

DRESSER®

Dresser Manufacturing Division
79 Fisher Ave., Bradford, Pennsylvania
In Canada: Toronto and Calgary.

ONE OF THE DRESSER INDUSTRIES



THE WORLD'S MOST EFFICIENT POWER EXHAUSTER

...for industry...for institutions...for residences

★ NO MOTORS, FANS OR BEARINGS IN EXHAUST LINE
★ NEEDS NO STACKS ★ ACID RESISTING VITREOUS ENAMEL FINISH

FOR INDUSTRY, Quickdraft excels in venting paint booths . . . abrasives . . . corrosive gases . . . noxious fumes . . . high temperatures and moisture. Its blower operates in clean or outside air. It eliminates down-time for cleaning and replacing fan blades. It improves industrial venting and reduces maintenance costs!

FOR INSTITUTIONAL AND COMMERCIAL BUILDINGS, Quickdraft efficiently vents heating plants, water heaters and incinerators at roof level. It saves the cost of building unsightly tall stacks.

FOR RESIDENCES, Quickdraft makes low, cold and erratic chimneys function. On and off with the fire, Quickdraft maintains constant draft required for efficient and economical combustion of all fuels. It eliminates pulsating or chattering, puffing, smoking and sooting.

SEND FOR QUICKDRAFT ENGINEERING DATA ON YOUR VENTING OR HEATING APPLICATIONS . . . TODAY.

IMPORTANT NOTICE

In addition to standard acid resisting vitreous enamel finish, all Quickdraft units are available in No. 316 Stainless Steel or in rigid Polyvinyl Chloride for withstanding highly corrosive gases. With static pressures up to 12-inches, Quickdraft is ideal for materials handling applications.

THE
Quickdraft
CORPORATION
P. O. Box 87-K, Dueber-Hampden
Bldg., Canton 1, Ohio

N-558-QD

WE HEAR THAT

Continued

▶ *AIR DEVICES, INC.* and *THERMOTANK, INC.* have combined their product design, development and manufacturing facilities to expand their product lines of air outlets and high velocity air conditioning systems.

▶ A new $1,500,000 plant for the production of industrial valves for automation and the nation's expanding missile program was opened in Fort Washington, Pa., recently by *MINNEAPOLIS-HONEYWELL REGULATOR CO.* The 120,000 sq ft plant, located 12 miles from downtown Philadelphia, provides manufacturing, research and development, sales and administrative facilities for the company's valve division.

▶ The fan testing laboratory at College Station, Texas, operated by the Texas Engineering Experiment Station, an activity of the Texas A. & M. College system, is the first to be approved by the Air Moving and Conditioning Association as a qualified neutral laboratory for testing centrifugal fans in accordance with the association's standard test code and laboratory standards. Use of this laboratory's facilities will be recommended to AMCA member companies. Fans up

---

for

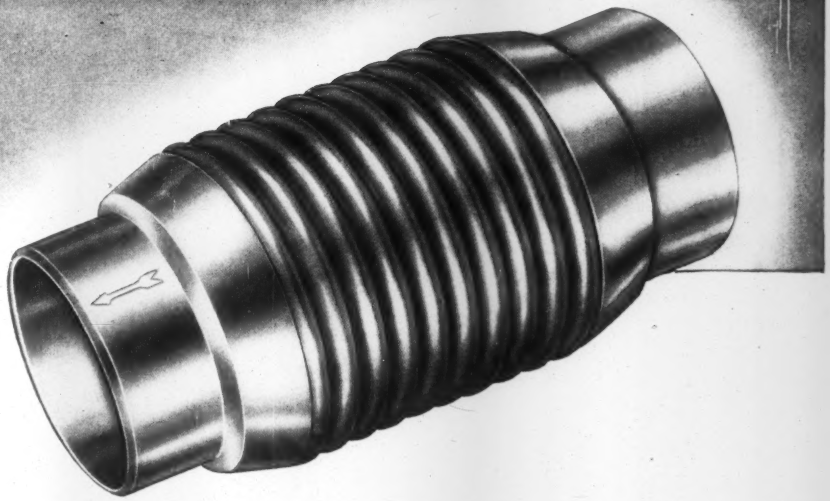
SPECIFICATION *and* BUYING INFORMATION

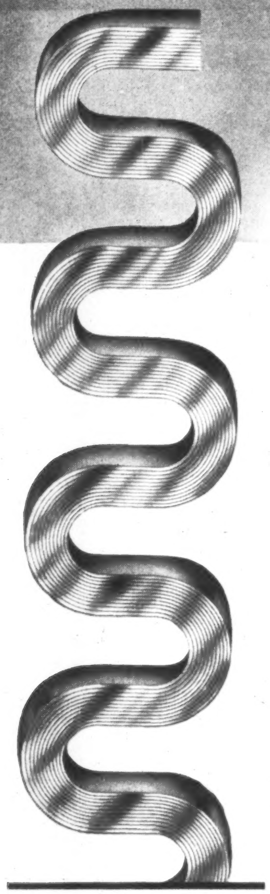
Use your complete, up-to-date

JANUARY DIRECTORY ISSUE

Your job will be a lot easier if you'll keep the January Directory issue of Heating, Piping & Air Conditioning constantly available for handy reference. It's one of your most valuable tools — one which will save you many hours of looking up the products you need for your various jobs. It's the ONE complete, up-to-date, readily accessible source of product information on who makes the pumps, valves, traps, compressors, specialties of all kinds, etc., you need — and where they're located. They're identified by trade names, too. EVERY product is listed, alphabetically arranged and printed on a distinctive yellow stock for easy reading and reference. Keep it handy . . . it's a time saver.

New MULTI-PLY EXPANSION JOINT gives greater ELASTICITY





Here's an expansion joint that's really different—it's the BOA expansion joint with the exclusive patented multi-ply corrugated element. Its greater elasticity, flexibility and longer life is the result of the superior cold-forming properties of extremely light-gage stainless steel strip. This "layer on layer" construction of the corrugated element resulting in low reaction to mechanical forces, permits greater responsiveness to expansion and contraction.

For your next piping job, investigate this superior product and see for yourself.

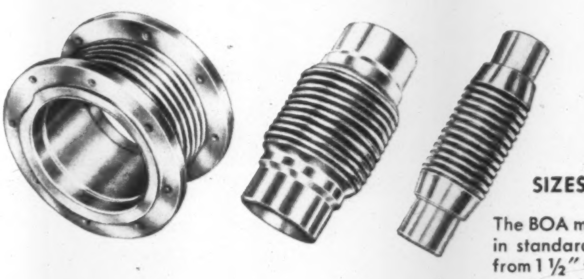
Write today for detailed and descriptive literature.

Exclusive

TERRITORIES

If you are a manufacturer's agent — ask us about some of the exclusive territories still open.

488



SIZES

The BOA multi-ply is made in standard sizes ranging from 1 1/2" to 24" for pressures to 400 psi. Others specially engineered for higher pressures and temperatures.

AMERICAN BOA multi-ply INCORPORATED

114 Liberty Street
New York, N. Y.

HERE THEY ARE!

THE WORLD'S FINEST INDUSTRIAL HEATERS

Gas fired Panelbloc radiant heaters "heat like the sun"—but do a more consistent job. You can enjoy their healthful heat twenty-four hours a day! Automatic. Easy installation. Burns any commercial type gas. Send for information.

PANELBLOC

Take a Cook's tour around the world and you'll find Thermobloc warm air heaters wherever you go. Manufactured and sold in 27 countries. Oil or gas fired. Economical, and they are made in a complete range of sizes for open area heating. No pipes or duct work needed.

THERMOBLOC

Thermobloc Div., Prat-Daniel Corp.
10-9 Meadow St., So. Norwalk, Conn.

Canadian Affiliate:
T. C. Chown, Ltd., Montreal - Toronto

Please send bulletins on ☐ Panelbloc ☐ Thermobloc

Name ....

Address ....

City .... State 10-9

WE HEAR THAT

Continued

to and including a double width, double inlet type with a discharge duct diameter of 50 in. may be tested there, the association reports.

▶ *THOR POWER TOOL CO.* has purchased *DRYING SYSTEMS, INC.* Drying systems will continue with the same management and personnel, and will operate as *DRYING SYSTEMS CO., DIV. OF THOR POWER TOOL CO.*

▶ *CLEVELAND FUEL EQUIPMENT CO.* recently completed a new addition to its plant at 1111 Brookpark Rd., Cleveland. The structure, providing 4600 sq ft of space, is designed to house the company's engineering department and a development laboratory. Plans are in progress to construct a two-story building in front of this latest addition which will include executive, sales and engineering conference rooms, together with display areas and training school facilities.

▶ Assets of *INSUL-MASTIC CORP. OF AMERICA* have been purchased by *PITTSBURGH COKE & CHEMICAL CO.* The newly acquired facilities will continue production of the "Insul-Mastic" line of as-

Write for new Bulletin!

WILSON CENTRIFUGAL BLOWDOWN SEPARATOR

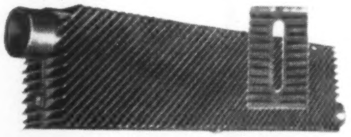
SOLVES BOILER BLOWDOWN DISPOSAL PROBLEMS

Here is the safe, economical way to handle boiler blowdown . . . at atmospheric pressure. Steam flash is instantaneously cleared through the large top vent pipe. Water and sludge fall by gravity through bottom drain. No objectionable noise. Install where convenient, inside or out—even on boiler room roof. One Wilson Separator can handle two or more boilers in battery, if desired. Special models with flanged or butt welding connections available.

- MEETS REQUIREMENTS OF A.S.M.E. UNFIRED PRESSURE VESSEL CODE
- SIMPLE TO INSTALL
- REQUIRES NO MAINTENANCE
- THOUSANDS IN SERVICE

WILSON ALL-CAST ALUMINUM RADIATION ELEMENTS

. . . provide maximum heat transfer with minimum weight. Rugged construction with high resistance to corrosion or electrolytic deterioration. You gain these advantages in Wilson Aftercoolers, Unit Heaters and other radiation products.



WILSON ENGINEERING CORPORATION

6 North Michigan Avenue Dept. H-9 Chicago 2, Illinois

Why ARE MORE AND MORE HEATING DEALERS DEMANDING RAYPAK GAS FIRED BOILERS?

BECAUSE THEY'RE LIGHT AND COMPACT . . . BUT THAT'S NOT ALL!

Only RAYPAK

Features integral finned copper water tube heat exchanger . . . strong and of highest efficiency, complete with tapered bronze headers and clean-out plugs — perfect hydraulics — high temperature resisting — rust proof.

Only RAYPAK

Features raised port pressed stainless steel burners of extraordinary performance—inaudible on ignition or extinction on any type of gas — the finest burner available, anywhere — mounted on a sliding drawer.

Only RAYPAK

Features gas modulation . . . the most advanced water temperature control system. Available in all Raypak heating and volume supply boilers. Check this typical curve — you can see why it's the finest.

SIZES 80,000 THROUGH 600,000 BTU's.

"Light as a feather"

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Raypak **COMPANY, INC.**

2416 CHICO AVENUE, EL MONTE, CALIFORNIA

Manufacturers' Agents . . .

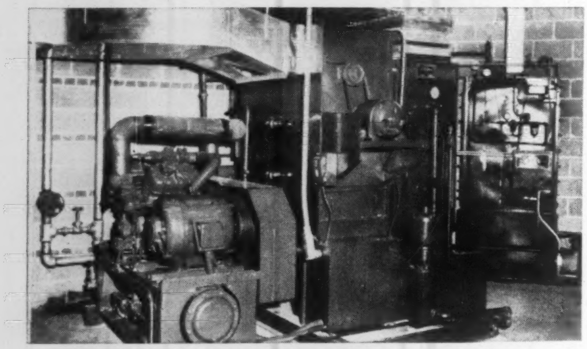
Are you interested in securing additional lines?

We are occasionally asked by our manufacturer advertisers to suggest the names of manufacturers' agents in various sections of the country whom they can contact in regard to representation of their industrial and large building heating, piping, and air conditioning products.

If you would like your name listed on our records for inquiries we may receive on your territory, we invite you to write us. There is no charge in connection with this service.

HEATING, PIPING & AIR CONDITIONING
6 North Michigan Avenue, Chicago 2, Illinois

DRY AIR...
PRECISELY as you want it



NIAGARA CONTROLLED HUMIDITY AIR CONDITIONING

This method removes moisture from air by contact with a liquid in a small spray chamber. The liquid spray contact temperature and the absorbent concentration, factors that are easily and positively controlled, determine exactly the amount of moisture remaining in the leaving air. Heating or cooling is done as a separate function.

The Niagara's Controlled Humidity Method using HYGROL moisture-absorbent liquid is

Best and most effective because . . . it removes moisture as a separate function from cooling or heating and so gives a precise result constantly and always.

Most reliable because . . . the absorbent is continuously reconcentrated automatically. No moisture-sensitive instruments are required to control your conditions.

Most flexible because . . . you can obtain any condition at will and hold it as long as you wish in either continuous production, testing or storage.

Easiest to take care of because . . . the apparatus is simple, parts are accessible, controls are trustworthy.

The cleanest because . . . no solids, salts or solutions of solids are used and there are no corrosive or reactive substances.

AT THE
CHEMICAL SHOW
26th EXPOSITION OF CHEMICAL INDUSTRIES
Coliseum, New York City, December 2 – 6, 1957
See NIAGARA . . .
AIR CONDITIONERS • *Aero* HEAT EXCHANGERS
Aero AFTER COOLERS • *Aero* REFRIGERANT CONDENSERS • *Aero* STEAM CONDENSERS
Aero VAPOR CONDENSERS • HUMIDIFIERS
HEATERS • COOLERS • DRYERS
BOOTH No. 655

Write for full information; ask for Bulletins 112 and 121. Address Dept. HP-9

NIAGARA BLOWER COMPANY
405 Lexington Ave., New York 17, N. Y.
District Engineers in Principal Cities of U.S. and Canada

WE HEAR THAT

Continued

phaltic coatings and insulating materials for sale through the parent company's protective coatings division.

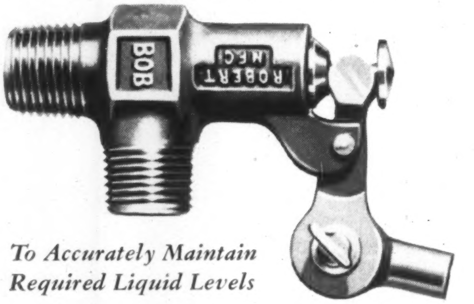
▶ *ROBERTSHAW-FULTON CONTROLS CO.* recently broke ground at Anaheim, Calif., for the construction of a new $250,000 western research center.

▶ *NATIONAL ELECTRIC PRODUCTS CORP.* and *A.M.BYERS CO.* have made an agreement whereby National Electric is given exclusive finishing and marketing rights to Byers' wrought iron electrical conduit.

▶ *AIR REDUCTION SALES CO., DIV. OF AIR REDUCTION CO., INC.* has started construction of a new air separation plant at Acton, Mass. The cost of the plant including related distribution facilities will be in excess of $9 million. The structure, which is scheduled for completion during the summer of 1958, is designed to produce 75 tons of liquid oxygen, nitrogen and argon per day.

▶ Trustees of the Foundation for Instrumentation Education and Research have announced the direction of

GUARANTEED



To Accurately Maintain Required Liquid Levels

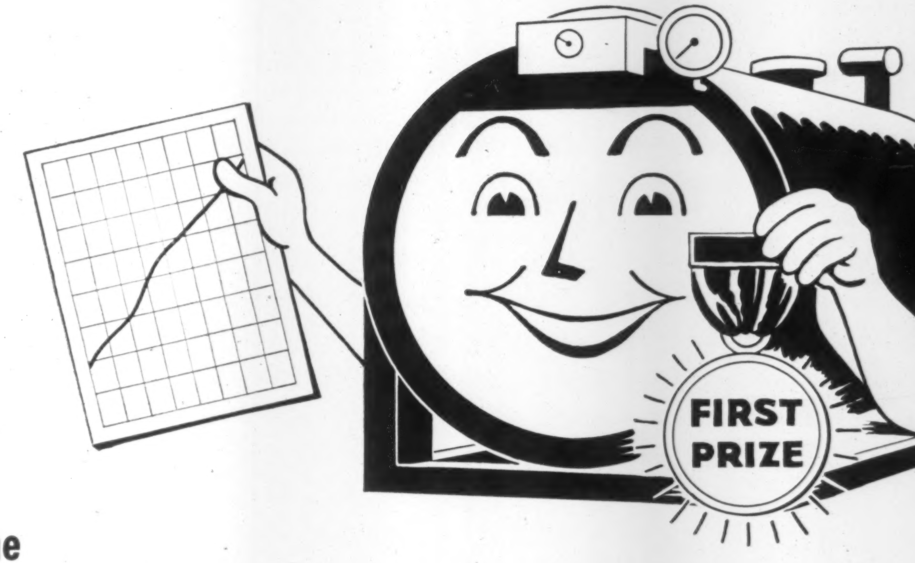
Specified for cooling towers and other commercial and industrial applications.

Positive-action . . . high capacity . . . heavy and light duty service. Solid brass, chrome plated brass, nickel or stainless steel construction. Won't chatter, leak or drip. Outperforms any other Valve under the toughest service conditions.

Competitively priced and available in sizes from ⅜ through 1½".

Write for details of complete line.
Distributed nationally.

ROBERT Manufacturing Company
9035 Venice Boulevard, Los Angeles 34, California



The Boiler they threw the book at

You know exactly what a Continental Automatic Boiler will do, even while it's still in our factory. That's because we test and re-test it, at every stage in its manufacture, then fire-test it before shipment for a final performance-proof of its guaranteed efficiency of more than 80%.

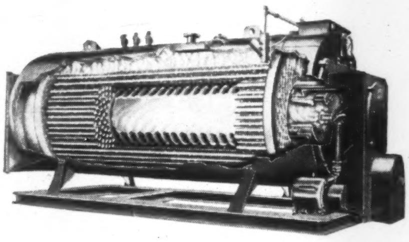
With a Continental, guesswork is out. You specify the right size for the job, not an oversized boiler just to play it safe. And each boiler-burner unit is rated on its own test-floor performance, not its square feet of heating surface.

Continental efficiency stays almost constant over a wide load range and a long service life. When plant expansion requires greater steam production, it's easy to add another performance-proved, fire-tested Continental Automatic Boiler — the boiler with the exclusive "Spinning Gas" feature. For details, send for Bulletin BE-3.

BOILER ENGINEERING & SUPPLY COMPANY, INC.

8 Manavon Street, Phoenixville, Pa.

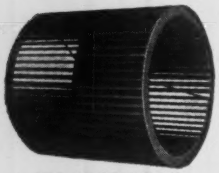
The Continental AUTOMATIC BOILER

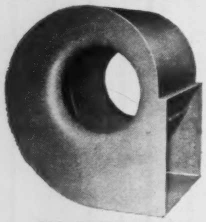


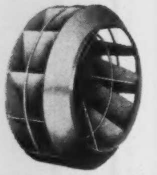
(Left) Series F Continental Automatic Boiler, with modulating control. Other models from 20 to 500 hp, with on-off, low-high-low or modulating controls, burn oil and/or gas. For steam heating or process work at pressures from 15 to 250 pounds, or for hot water heating at low or high temperatures.

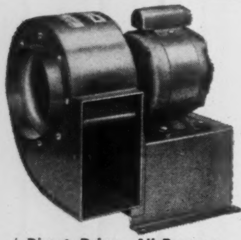
A HALF CENTURY OF BOILER MANUFACTURING EXPERIENCE

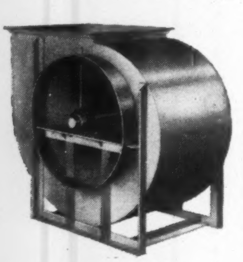
Make
BARRY
BLOWER COMPANY
your dependable low cost source of supply for
POWER FAN EQUIPMENT


BFC, DI-DW Wheel


BFC, DI-DW Housing


BBI Blower Wheel SI-SW. Class 2.


↑ Direct Drive, All-Purpose Utility Blower


BBI Blower, SI-SW Arrangement No. 3, class 4 →

We offer users of power fan equipment a full line of blowers, multiple blower assemblies, direct and belt driven ventilating sets, cast iron blowers and various types of centrifugal blower wheels and housings. All sizes from 6" to 73".

ALL BARRY blower wheels and housings are precision made from steel, aluminum, brass, copper or stainless, and are expertly balanced and trued before shipment.

We make power fan equipment *exclusively*, and do not compete with our own customers . . . . . and, we have a high reputation for dependable quality and remarkably fast deliveries. Let us quote on our standard equipment, or upon your special sizes and specifications. Write us today.

REPRESENTATIVES: A few territories available for sales representatives

BARRY BLOWER CO.
3100 California Street N.E. • Minneapolis 18, Minnesota

WE HEAR THAT

Continued

a $4000 stipend to an "Instrument Society of America Graduate Fellowship in Instrumentation" at Case Institute of Technology. The formal award of the fellowship will be made as a part of the 12th Annual ISA Instrument-Automation Conference and Exhibit held in Cleveland this month.

▶ Ground breaking ceremonies were held recently in Richmond, Texas, for the construction of a new iron and steel foundry for *W-K-M MFG. CO., DIV. OF ACF INDUSTRIES, INC.* The facility will be a 173,000 sq ft multiple span steel and corrugated sheathing building of one-story construction. Construction cost is estimated at $1 million.

▶ The recently organized consulting engineering firm of *P. H. ZIEL-J. S. BLOSSOM & ASSOC.* is now located in larger quarters at 206 E. Sixth St., Cincinnati.

▶ *GORTON HEATING CORP.* recently celebrated the 70th anniversary of its founding. The original corporate name was Gorton & Lidgerwood Co., incorporated in 1887. In 1927 the name was changed to Gorton Heating Corp.

YOU CAN BUY AIR FILTERS WITH CONFIDENCE FROM MEMBERS OF...

The Air Filter Institute

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Air Devices, Inc.
185 Madison Avenue
New York 16, New York

Air Filter Corporation
108 N. Water Street
Milwaukee 5, Wisconsin

Air-Maze Corporation
25000 Miles Road
Cleveland 28, Ohio

American Air Filter Co., Inc.
215 Central Avenue
Louisville 8, Kentucky

Continental Air Filters, Inc.
2520 Helm Street
Louisville, Kentucky

Dollinger Corporation
20 Centre Park
Rochester 3, New York

Drico Industrial Corporation
100 Eighth Street
Passaic, New Jersey

Owens-Corning Fiberglas Corporation
1833 National Bank Building
Toledo 1, Ohio

Pittsburgh Plate Glass Company
Fiber Glass Division
One Gateway Center
Pittsburgh 22, Pennsylvania

Research Products Corporation
1015 E. Washington Avenue
Madison 10, Wisconsin

Somers Corporation
6063 Wabash Avenue
Detroit 8, Michigan

***Technical Filter Co.**
2719 South Poplar Avenue
Chicago 8, Illinois

Trion, Inc.
1000 Island Avenue
McKees Rocks, Pennsylvania

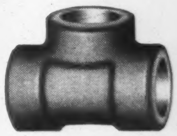
Vortox Company
121 S. Alexander Avenue
Claremont, California

Westinghouse Electric Corporation
Sturtevant Division
Hyde Park, Boston 36, Massachusetts

*Formerly Wilson & Co., Inc.

CRANE
QUALITY MATERIALS
FOR WELDED PIPING

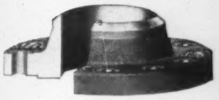
90° butt-welding elbow—Crane offers 16 different butt-welding fittings—½" to 24" for all pipe strengths.



Socket-welding tee—The Crane line of socket-welding fittings includes 9 different types for sizes ⅛" to 4"; 2000, 3000, 4000, 6000 lb. W. O. G.—non-shock—temps. 100° to 1000° F.

CRANE
STEEL
150

Crane butt-welding globe valve—The Crane butt- and socket-welding end valve lines include bolted bonnet, lip-seal, pressure-seal and union bonnet valves in a variety of globe, gate, angle and check designs.



Forged steel welding-neck flange—One of 3 standard types of forged steel flanges available from Crane for welded piping.

Send for this NEW Crane Circular of Welding Fittings, Flanges, Valves

A concise four-page guide to Crane's complete stocks of welding fittings, flanges and valves is available for your reference use. It provides you with a fast, accurate method of ordering *all* of your welding piping materials *from one source of supply.*

Ordering everything from Crane is your assurance that your jobs will be installed with top-quality materials throughout. Crane branch warehouses in 140 cities and Crane wholesalers throughout the country are ready to serve your requirements for welded piping materials.

Make sure that you get your copy of the new Crane Welded Piping Materials Circular quickly. Fill in and mail the coupon today. If you want an extra copy for your welding shop, check the coupon as indicated.

CRANE **VALVES & FITTINGS**
PIPE • PLUMBING • KITCHENS • HEATING • AIR CONDITIONING

Since 1855—Crane Co., General Offices: Chicago 5, Ill.
Branches and Wholesalers Serving All Areas

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836 S. Michigan Ave., Chicago 5, Ill.

Gentlemen: Please send me ( ) a copy of your new Welded Piping Materials Circular No. AD-2289 ( ) and an extra copy for our welding shop.

Your Name____________________

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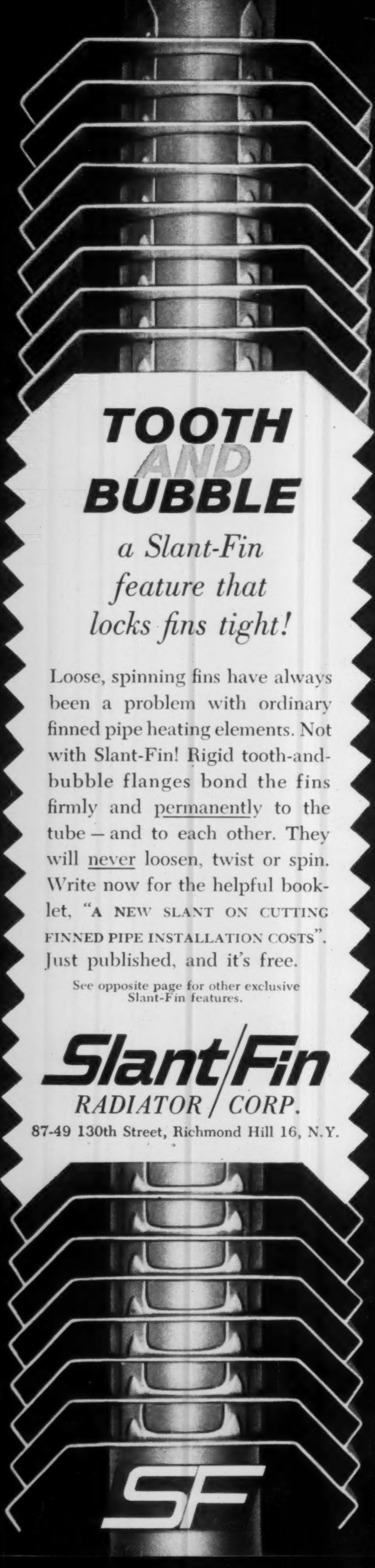

TOOTH AND BUBBLE

a Slant-Fin feature that locks fins tight!

Loose, spinning fins have always been a problem with ordinary finned pipe heating elements. Not with Slant-Fin! Rigid tooth-and-bubble flanges bond the fins firmly and permanently to the tube — and to each other. They will never loosen, twist or spin. Write now for the helpful booklet, "A NEW SLANT ON CUTTING FINNED PIPE INSTALLATION COSTS". Just published, and it's free.

See opposite page for other exclusive Slant-Fin features.

Slant/Fin
RADIATOR / CORP.
87-49 130th Street, Richmond Hill 16, N.Y.

WE HEAR THAT

Continued

▶ The schedule of classes for the 1957-58 *AMERICAN BLOWER DIV. OF AMERICAN-STANDARD* commercial air conditioning training school has been announced. The school's second year of operation will begin with a service course this month and will continue through May of next year. Eighteen one-week courses are being offered. Fourteen deal with service and four with application of commercial air conditioning equipment.

▶ *De LAUREAL & MOSES*, consulting engineers, New Orleans, has moved from 201 Nola Bldg. to 929 Howard Ave. in that city.

▶ Twelve U.S. and Canadian college and university engineering graduates have completed an advanced engineering training program of *TRANE CO.* Dealing with practical applications of engineering principles, the training is designed to prepare the engineer for his future in the air conditioning industry.

▶ *WESTINGHOUSE ELECTRIC CORP.* plans to add approximately one-third space to its present air conditioning plant in Staunton, Va. The addition, covering more than 87,000 sq ft of space, will be constructed as a 120 ft extension to the present building. Most of the space will be used to enlarge the area available for receiving and warehousing departments.

▶ *TUBE TURNS* observed its 30th anniversary on July 19.

▶ *AMERICAN AIR FILTER CO., INC.* has graduated its first class from a five month technical training school. The group's curriculum included the theory of air and its properties, characteristics, movements, etc., and elements of electricity, properties of dust, heat transfer, etc. Also covered were product design, performance characteristics, fields of application, and state codes.

▶ *FARR CO.* has completed a 28,000 sq ft addition to its El Segundo, Calif., plant. The $250,000, two-story structure is designed to increase both manufacturing and engineering facilities.

▶ Ground breaking ceremonies took place at Murray Hill, N. J., recently at the research laboratories of *AIR REDUCTION CO., INC.* A two-story polymer laboratory, to cost over a half million dollars, will be built there to house additional chemical research facilities.

WE HEAR THAT

Continued

▶ *ROBERTSHAW-FULTON CONTROLS CO.* scholarships for four years at leading engineering colleges have been awarded to five high school graduates. The winners, chosen for their superior scholastic record, will study electrical and mechanical engineering. To be eligible, candidates had to be residents of counties where the company has plants.

▶ *DAY & NIGHT MFG. CO.'s* new $6,500,000 plant in Puente, Calif., is reported to be approaching completion on schedule. The 500,000 sq ft structure will house manufacturing, engineering and office facilities.

▶ *TENNEY ENGINEERING, INC.* is celebrating its 25th anniversary this year.

▶ *ORANGEBURG MFG. CO., INC.* has acquired 3½ acres of plant site and 40,000 sq ft of manufacturing facilities in Marion, Ind., expanding production facilities for the company's "SP" plastic pipe.

▶ *TRANE CO.* has been awarded a bronze plaque in recognition of achieving over 1 million man hours of production without a single lost time accident. The award was presented to *JOHN CANTWELL*, works manager, by Employers Mutuals of Wausau.

▶ *MANNING, MAXWELL & MOORE, INC.* has opened a new district office and factory warehouse in Bellwood, Ill., to serve the greater Chicago area.

▶ A new warehouse facility located at 1722 Walden Ave., Buffalo, has been erected by *WHEELING CORRUGATING CO.* The structure provides 40,000 sq ft of floor space.

▶ *WILL-BURT CO.* has added 20,000 sq ft of plant production facilities.

▶ The Pittsburgh district office of *BRISTOL CO.* has been moved to a new building at 2250 Noblestown Rd. The facility will house the company's sales and service staffs.

▶ A new continuous coil annealing furnace has been put into operation at *CHICAGO SCREW CO.* The gas fired, radiant tube unit is designed to process upwards of 50 tons of rod or hot rolled wire per day.

▶ *LOGAN CLAY PRODUCTS CO.* plans to build a $1 million, 52,000 sq ft clay pipe plant. The proposed structure will be located adjacent to present company facilities in Logan, Ohio.

FIN
TOUCH
FIN

a Slant-Fin feature that eliminates noise!

Ordinary finned pipe heating units rattle, ping and pong. Slant-Fin doesn't—ever! Fin tips touch each other to create a remarkably effective sound absorber. The result: no more expansion and contraction racket. Fewer call-backs with Slant-Fin. Write now for helpful booklet, "A NEW SLANT ON CUTTING FINNED PIPE INSTALLATION COSTS". Just published, and it's free.

See opposite page for other welcome Slant-Fin features.

Slant/Fin
RADIATOR / CORP.
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WEBSTER

COMBUSTION EQUIPMENT
ENGINEERED
By . . . . THE
WEBSTER
ENGINEERING
COMPANY

Research

Engineering

Design

Manufacturing

Sales

Service

- - - All are available through Webster's Service and Sales organization. Offices are located throughout the country.

It has always been the policy of Webster to make personal contact on every job — a Webster Combustion Installation must be satisfactory.

The engineering service departments of Webster and its exclusive agents would welcome the opportunity to help solve your combustion problems, to make recommendations and quotations.

Webster equipment is marketed through ® JANITROL district offices and many other exclusive agents.

The
WEBSTER ENGINEERING
Company
TULSA 16, OKLAHOMA

Division of SURFACE COMBUSTION CORPORATION, Toledo, Ohio

WE HEAR THAT

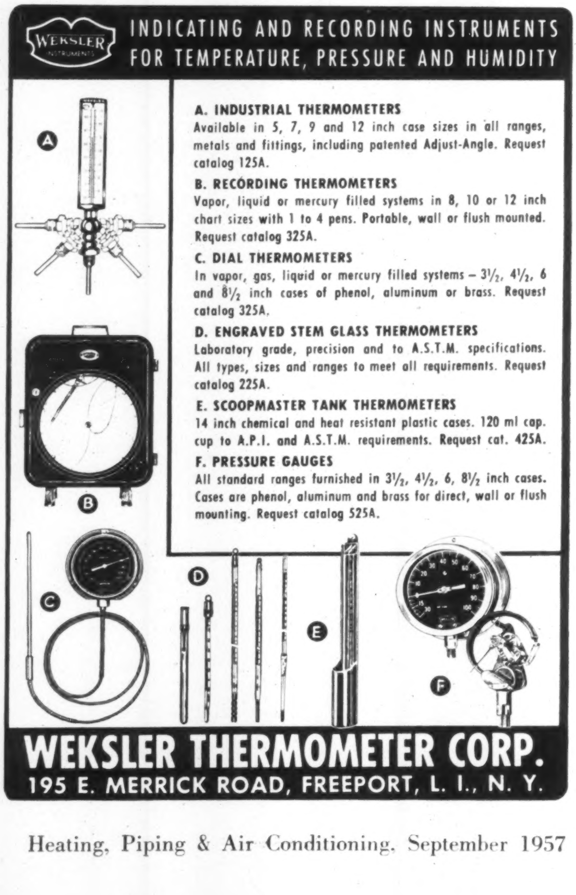
Continued

▶ The new Indianapolis steel service plant of *JOSEPH T. RYERSON & SON, INC.* is now open for business, the company reports. Representing an investment of over $1 million, the structure will serve Indianapolis and southern Indiana.

▶ For the 10th successive year *TRANE CO.'s* annual report has been adjudged "excellent" as a shareholder communication, and a merit award recipient in U. S. competition, the company reports. The award was presented to Trane in the form of a citation by *Financial World* magazine following that publication's 17th annual report survey.

▶ *Facts 'n Figures* is the title of *CARLIN CO.'s* new quarterly publication designed to keep wholesalers and their contractor-dealers informed with news items, sales ideas, and installation and service helps.

▶ *FASCO INDUSTRIES, INC.* is now in the process of setting up a nationwide distributing organization, the company reports. Present plans call for the establishing of distributors in all major cities. +



INDICATING AND RECORDING INSTRUMENTS FOR TEMPERATURE, PRESSURE AND HUMIDITY

A. INDUSTRIAL THERMOMETERS
Available in 5, 7, 9 and 12 inch case sizes in all ranges, metals and fittings, including patented Adjust-Angle. Request catalog 125A.

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Vapor, liquid or mercury filled systems in 8, 10 or 12 inch chart sizes with 1 to 4 pens. Portable, wall or flush mounted. Request catalog 325A.

C. DIAL THERMOMETERS
In vapor, gas, liquid or mercury filled systems – 3½, 4½, 6 and 8½ inch cases of phenol, aluminum or brass. Request catalog 325A.

D. ENGRAVED STEM GLASS THERMOMETERS
Laboratory grade, precision and to A.S.T.M. specifications. All types, sizes and ranges to meet all requirements. Request catalog 225A.

E. SCOOPMASTER TANK THERMOMETERS
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F. PRESSURE GAUGES
All standard ranges furnished in 3½, 4½, 6, 8½ inch cases. Cases are phenol, aluminum and brass for direct, wall or flush mounting. Request catalog 525A.

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195 E. MERRICK ROAD, FREEPORT, L. I., N. Y.

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Extra-Profits
in your
pocket
with

"engineer-approved"

ELGEN *All-Tite* VANE RUNNERS

NOW IN COILS!

OPEN THIS END
PULL HERE THIS END UP USE NO HOOKS
Save Time and Money... with ELGEN All-Tite VANE RUNNERS

THE EASIEST AND QUICKEST WAY EVER DEVISED
for installing single or double blade turning vanes in square elbows. No special tools required.

New production machinery of our own exclusive design, now enables us to produce button type Elgen All-Tite vane runners in continuous coils, effecting a savings in *your cost per job.*

COILED ELGEN ALL-TITE VANE RUNNERS MEANS . . .

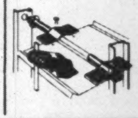
- *Less Waste!* Waste pieces due to short ends are a thing of the past. Vane runner metal is coiled in 100 foot lengths, you just pull out the exact footage needed.
- *Easier Storage!* Each coil weighs approximately 50 lbs. and is packed in a box 28" x 28" x 5". Box fits easily under bench or against wall.
- *Easier Handling!* No loose pieces lying around to get in the way or collect dirt.
- *Unrolls absolutely flat!* Vane runner metal emerges from the box at bench height . . . absolutely flat . . . ready for use.

TWO MORE ENGINEER-APPROVED ELGEN PRODUCTS THAT SAVE YOU TIME AND MONEY

ELGEN SILENT DUCT

. . . for forming "flexible" duct connectors. A one piece metal to material unit, packed in coils, unrolls absolutely flat. Makes on the spot work a cinch.

ELGEN DAMPERSET



. . . for multi-blade dampers, parallel or opposed. Most perfect damper hardware developed.

ELGEN PRODUCTS ARE SOLD THROUGH LEADING JOBBERS EVERYWHERE.

Write today for free catalog and "spec" sheet!

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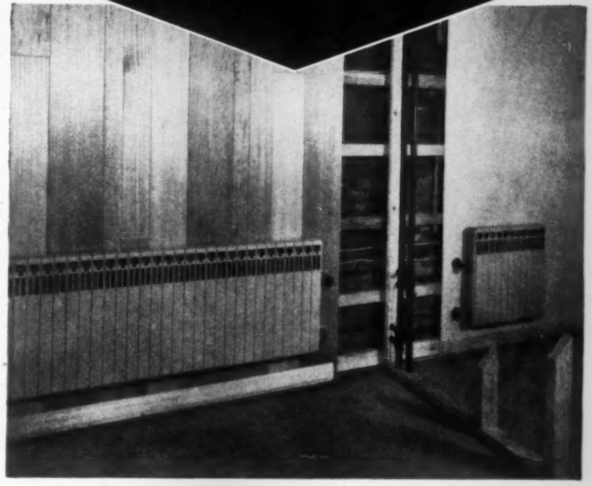
41-34 39th Street, Long Island City 4, N. Y.

REDUCE piping costs ... SPEED installation

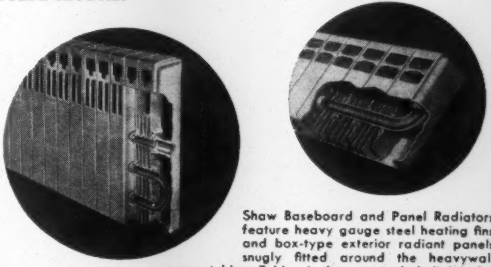


with SHAW Radiators

Only Shaw, of all modern radiators, offers *same end* as well as opposite end tapping. Same end tapping has a place in almost every piping layout, and its use invariably means less piping materials, simplified pipe fitting.

Important savings in installation time are made with *any* Shaw model, regardless of tapping arrangement. Shaw units are compact, fully self-contained assemblies only 3" thick, easy to handle and mount. There are no dampers, or separate housings to fit and install.

Shaw Radiators distribute both radiant and convected heat in unvarying, health-guarding proportions that create natural thermal comfort in a room. They use either hot water or steam up to 150 psi. Write today for free literature on both panel and baseboard models.



Shaw Baseboard and Panel Radiators feature heavy gauge steel heating fins and box-type exterior radiant panels snugly fitted around the heavywall copper tubing. Tubing is then expanded slightly by 3750# hydraulic pressure to hold all components as a rigid, self-contained unit. The tight metal-to-metal bond assures rigidity and full heat conduction.

SHAW-PERKINS
MANUFACTURING COMPANY
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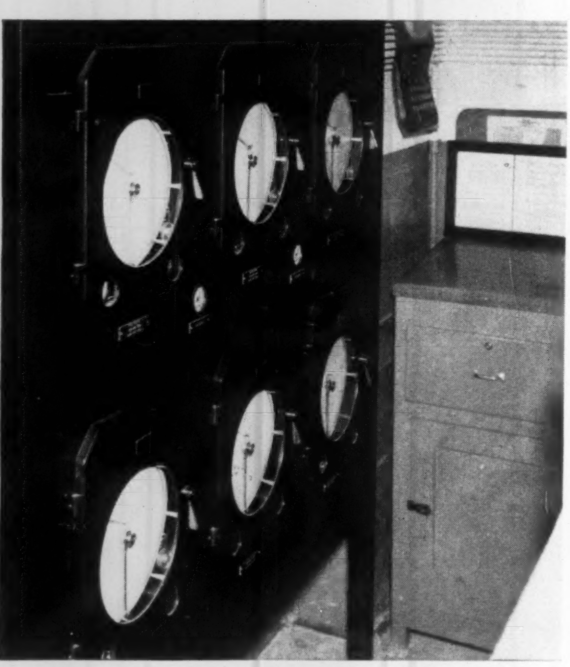
HOW TO POLISH YOUR BRASS



Air conditioning controls for the executive offices of a well-known Mid-Western Corporation.

KEEP your executive offices cool and clean the year round with Taylor Automatic Dew Point Control . . . the most direct temperature and humidity control system available. Be sure to tell your engineering contractor you want Taylor air conditioning instrumentation. A Taylor Application Engineer will work with him in laying out the system and making final adjustments.

This highly versatile Taylor Automatic Dew Point Control System uses:

1. Dry Bulb Controller for pre-heating outside air to a constant temperature.
2. Wet-and-Dry Bulb Controller applied to air washer for dew point and humidity control.
3. A summer-winter changeover controller for positioning dampers.
4. A Type-P Expansion-Steam Controller for protection against spray water freezeup.

Ask your Taylor Field Engineer for details of Taylor controls for air conditioning systems—for human comfort—or for product quality. Or write for **Catalog 5.** Taylor Instrument Companies, Rochester, N. Y., or Toronto, Canada.

Taylor Instruments
MEAN ACCURACY FIRST

MEETINGS & CONVENTIONS

1957

SEPT. 9-13—*12th Annual Instrument-Automation Conference and Exhibit.* Cleveland Auditorium. Cleveland. Sponsored by Instrument Society of America, 313 Sixth Ave., Pittsburgh 22. Exhibit information: Fred J. Tabery, 3443 S. Hill St., Los Angeles.

SEPT. 12-13—*Institute for Designing the Indoor Climate.* University of California at Los Angeles. Conducted by University of California Extension and UCLA department of engineering in cooperation with Institute of Heating and Air Conditioning Industries. Information: University of California Extension. Engineering, Los Angeles 24.

SEPT. 13-14—*Associated Insulation Contractors of the Western States,* 16th annual meeting. El Coronado Hotel, San Diego. Information: Insulation Distributor-Contractors National Association, Inc., 1632 K St., N. W., Washington, D. C.

SEPT. 17-20—*Insulation Distributor-Contractors National Association, Inc.,* second annual convention.

FORCED AIR — NO FAN THAT'S NO BOAST ASK OUR REPS FROM COAST TO COAST*!

Jetty SALUTES THESE FORWARD LOOKING REPRESENTATIVES OF

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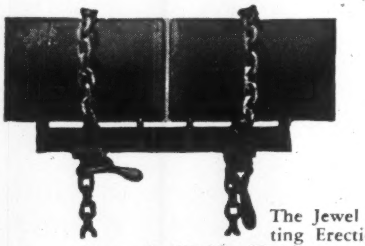
PIPE WELDING CLAMPS THAT MAKE WELDING PAY



Pipe clamps
Flange Clamps
Elbow Clamps
Angle Clamps
Pipe Markers

TWO SIZES
½ to 8 in. 8 to 16 in.
Light—Adjustable—Fast

The Jewel System of Pipe and Fitting Erection Ready for the Weld
Keeps the Welder Welding Instead of Waiting
CUTS ERECTION COSTS
Modernize Your Own Methods and Tool Equipment
JEWEL MANUFACTURING COMPANY
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PIPE HANGERS

FOR

HEATING – PLUMBING POWER & PROCESS

- SINGLE ROD SUSPENSION
- VERTICAL ADJUSTMENT
- UNRESTRICTED HORIZONTAL MOVEMENT
- MINIMUM HEAT LOSS THRU HANGER

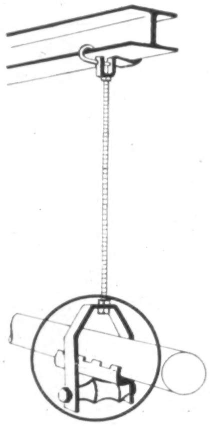
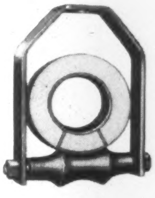


FIG. 140 ROLL HANGER WITH PIPE COVERING PROTECTION SADDLE



Our catalogue illustrates a complete line of Pipe Hangers & Supports and is an indispensable reference book for engineers, contractors, estimators & erectors. Write for your copy now.

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EASY TO INSTALL . . . LONGER LIVED

AMERICAN-MARSH *Redi-Return*

CONDENSATION UNITS

With Centrifugal Pumps — Vertical or Horizontal Motors — 1750 or 3500 RPM

Available in wide range of types and sizes

CAPACITIES: From 1,000 to 100,000 square feet direct cast iron radiation or equivalent.

PRESSURES: To 100 pounds per square inch.

TEMPERATURES: Handles water and condensate up to 200°F.

"Pumps and Pumps Only Since 1873"

AMERICAN-MARSH PUMPS

This Bulletin can help you select a better-designed Condensation Unit

ACT NOW TO GET COMPLETE DATA on these American-Marsh *Redi-Return* Condensation Units. Then judge for yourself the better engineering and quality of pump and tank . . . built for extra years of trouble-free service.

EASY-TO-INSTALL DESIGN helps you . . . only two pipe connections are needed. Motor-pump units can be removed without disturbing piping.

THE BULLETIN shows sizes from 10,000 to 100,000 sq. ft. EDR, cast iron or copper-bearing steel tanks and single or duplex motors of 1750 or 3500 RPM. Optional mounting base styles suit any installation, even crowded locations. Performance Tables and "How to Select" suggestions make this bulletin most helpful to you. *Get your copy now*

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In Canada: American-Marsh Pumps (Canada) Ltd., Stratford, Ont.

CENTRIFUGAL, TURBINE, STEAM AND POWER PUMPS FOR TESTING, PROCESSING, BOILER FEED, FIRE PROTECTION, ETC

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APPROVED BACKING RINGS FOR WELDING PIPE, VALVE, and FITTING JOINTS

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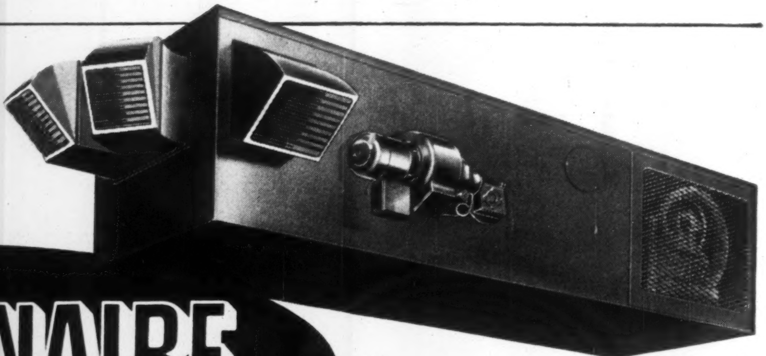
DOMINANT
name in overhead heating is still . . .



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Gas or oil-fired units designed especially for commercial and industrial installations

- **Backed by 18 years of specialized overhead heating experience!**
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- **Producing exclusively suspended type heating equipment!**

Models available for Gas or Oil from 95,000 to 405,000 B.T.U. output

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OVERHEAD HEATERS

OverHead Heaters, Inc.

1612 BOOK BUILDING • DETROIT 26, MICHIGAN • WOodward 2-4647
Factory Location: Kalamazoo, Michigan

MEETINGS & CONVENTIONS *Continued*

1957

St. Francis Hotel, San Francisco. Information: IDCNA, 1632 K St., N. W., Washington, D. C.

OCT. 1-4—*National Association of Corrosion Engineers*, north central regional meeting, Chicago. NACE headquarters: 1061 M & M Bldg., Houston 2.

OCT. 1-4—*National Association of Corrosion Engineers*, south central regional meeting, Oklahoma City. NACE headquarters: 1061 M & M Bldg., Houston 2.

OCT. 6-8—*Fluid Controls Institute.* Westchester Country Club, Rye, N. Y. Information: Fluid Controls Institute, Inc., P. O. Box 191, Decatur, Ill.

OCT. 7-9—*American Gas Association*, annual convention. Kiel Auditorium, St. Louis. AGA headquarters: 420 Lexington Ave., New York 17.

OCT. 7-9—*National Electronics Conference.* Hotel Sherman, Chicago. Information: National Electronics Conference, 84 E. Randolph St., Chicago 1.

OCT. 10-11—*Eighth Annual National Noise Abatement Symposium.* Hotel Sherman, Chicago. Information: J. J. Kowal, conference secretary, Armour Research Foundation, 10 W. 35th St., Chicago 16.

OCT. 21—*Second Annual Air Pollution Symposium.* Franklin Institute, Philadelphia. Subject: "Particulate Emission." Information: Franklin Institute, Benjamin Franklin Pkwy. at 20th, Philadelphia 3.

OCT. 21-25—*45th National Safety Congress & Exposition.* Conrad Hilton Hotel, Chicago. National Safety Council, 425 N. Michigan Ave., Chicago 11.

OCT. 22-24—*National Association of Corrosion Engineers*, seventh annual western regional conference. San Diego. Information: NACE, 1061 M & M Bldg., Houston 2.

OCT. 28-31—1957 *Trade Fair of the Atomic Industry.* Coliseum, New York. Information: Atomic Industrial Forum, Inc., 3 E. 54th St., New York 22.

OCT. 30-31—*Industrial Hygiene Foundation*, 22nd annual meeting. Mellon Institute, Pittsburgh. Information: Mellon Institute, 4400 Fifth Ave., Pittsburgh 13.

OCT. 31-*NOV.* 2—*Western Society of Engineers*, national conference. Edgewater Beach Hotel, Chicago.

Therm-O-Tile
REG. U. S. PAT. OFFICE

CONDUIT
FOR
UNDERGROUND
PIPING

• PERMANENT • ECONOMICAL
• SIMPLE • EFFICIENT

THIS MONTH'S DESIGN SUGGESTION

How to Build a Branch Therm-O-Tile Take-off

The Above Shows a Therm-O-Tile Branch Take-off Detail — Properly Insulated and with Ample Provision for Expansion and Contraction.

FOR ADDITIONAL DESIGN DETAILS AND GENERAL INFORMATION ASK FOR
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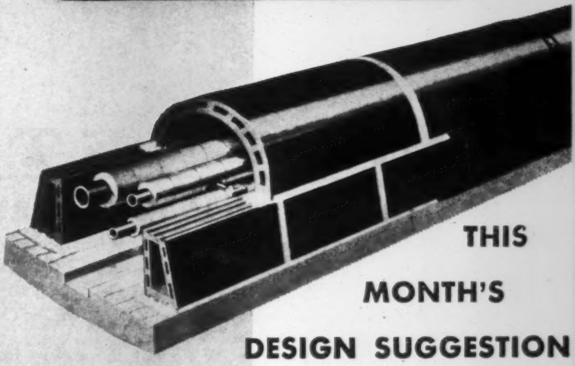
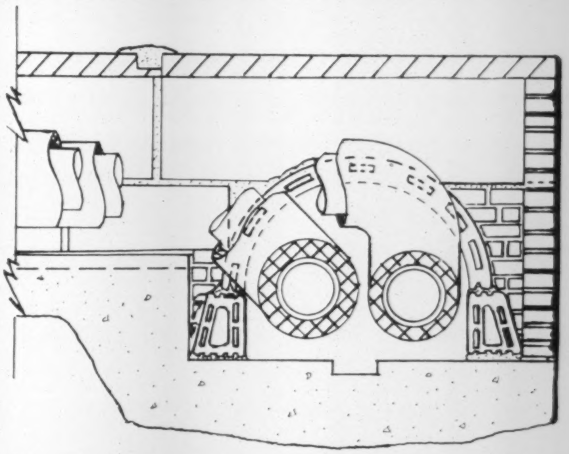
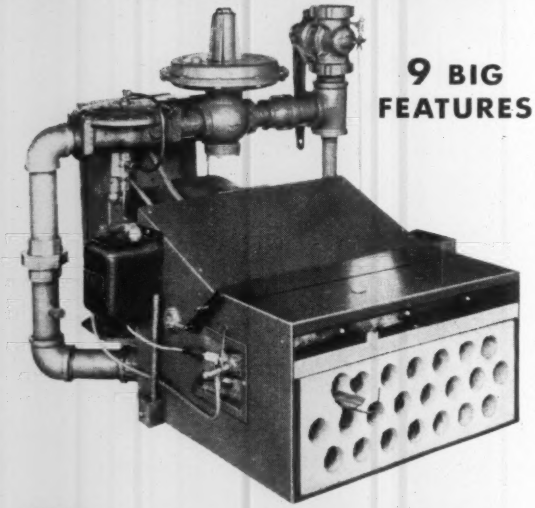
Insulation Engineers and Contractors





FOR GAS AND OIL

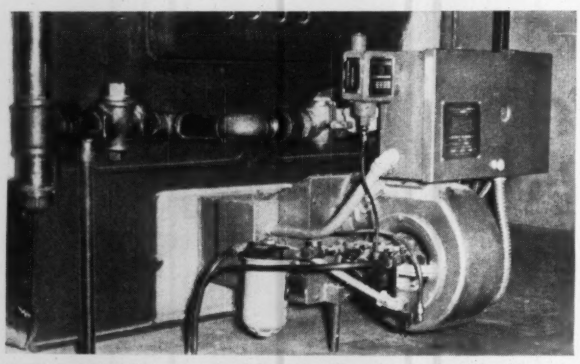


LO-BLAST

POWER-TYPE DUAL FUEL BURNER

The finest gas burner...the finest oil burner...now combined in one great unit! Another Lo-BLAST engineering achievement! Check these features—

- **Highest efficiency on either gas or oil.** Lo-BLAST design assures maximum fuel economy.
- **Laminar Flame Oil Burner.** Wide flat flame—no impingement on walls or crown sheet.
- **Fits low base boilers.** Installs through average ashpit door.
- **Reliable—safe.** Factory tested. Underwriters' Laboratories approved.
- **Complete package.** Shipped assembled and wired.
- **Manual or automatic fuel selector.** Damper transfers blower air to either gas or oil burner. Damper position governs switching action to controls.
- **Soft quiet flame.** *Low* pressure combustion air keeps both oil and gas flames quiet.
- **Safety purge cycle.** 30 second purge on each call for heat—also on fuel changeover.
- **No coking or clogging of oil nozzle.** Shield protects oil manifold against reflected heat. Air cooled during gas cycle.



Send now for literature on this sensational new dual fuel burner

MID-CONTINENT
METAL PRODUCTS CO.
1960 N. Clybourn Ave., Chicago 14, Ill.

MEETINGS & CONVENTIONS

Continued

1957

Sponsored by Engineers Joint Council. Scientific Manpower Commission. National Science Foundation and National Academy of Sciences National Research Council. Information: Engineers Joint Council, 29 W. 39th St., New York 18.

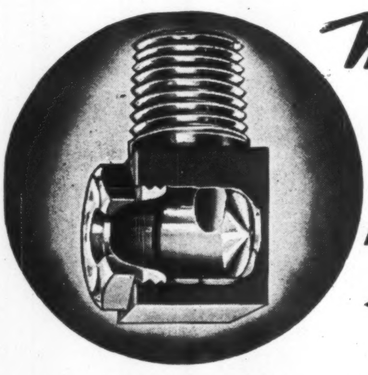
NOV. 12-14—*National Association of Corrosion Engineers*, northeast regional meeting. Pittsburgh. NACE headquarters: 1061 M & M Bldg., Houston 2.

NOV. 13-14—*Air Pollution Conference.* Chicago. Cosponsored by Armour Research Foundation and Midwestern Air Pollution Prevention Association. Information: Conference secretary, Armour Research Foundation, 10 W. 35th St., Chicago 16.

NOV. 13-16—*National Association of Corrosion Engineers*, technical meeting and corrosion control short course. Key Biscayne Hotel, Key Biscayne, Fla. Conducted by Miami section of NACE. NACE headquarters: 1061 M & M Bldg., Houston 2.

NOV. 14-16—*American Society of Refrigerating Engineers*, semi-annual meeting. Chicago. ASRE headquarters: 234 Fifth Ave., New York.

Monarch



NOZZLES
for
AIR WASHERS

These are "non-clogging" nozzles with a single large tangential lead hole to the swirl chamber that will never clog from any impurities small enough to pass through the orifice. Swirl chamber is conical on both ends and pivots liquid like a top to produce an exceptionally fine, evenly distributed, balanced spray of about 80° included angle. Wider spray angles up to 130° can be furnished to order.
Standard material Brass. Also available in Stainless Steel and Monel. Pipe sizes from 1/8" to 1". 1/4" size is 1-5/16" long and made from 5/8" square stock.

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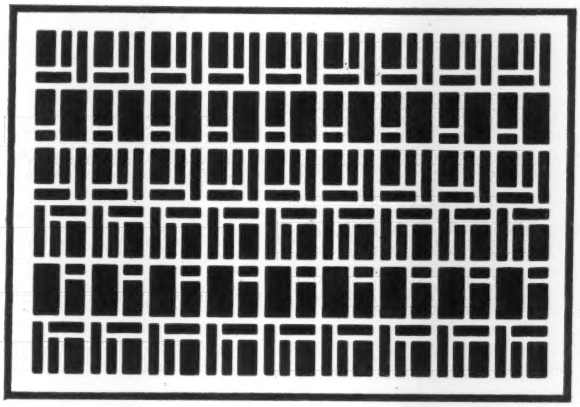

a ARCHITECTS *specify*
b BUILDERS *approve*
c CONTRACTORS *buy*

. . . Hendrick grilles

Architects, Builders and Contractors all agree you can't beat Hendrick Architectural Grilles for overall attractiveness and functionalism! Hendrick Perforated Metal Grilles not only provide plenty of open area for the free passage of air, but they're easy to install — always lie flat, and can't bend or warp!

Over a hundred designs are available, many are exclusive only with Hendrick. Each design can be furnished in a wide range of dimensions, bar sizes, number and size of perforations. Write for details, today!

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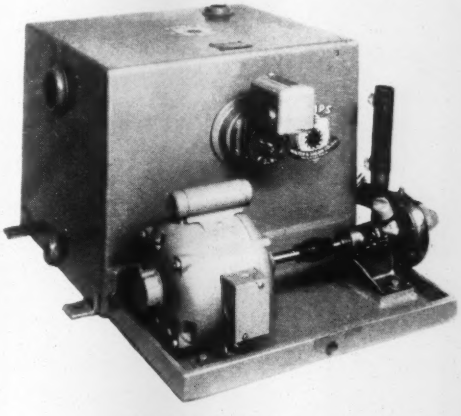
MANUFACTURING COMPANY
48 DUNDAFF STREET CARBONDALE, PA.
Perforated Metal • Perforated Metal Screens • Wedge-Slot Screens • Hendrick Wedge Wire Screens • Architectural Grilles Mitco Open Steel Flooring — Shur-Site Treads • Armorgrids Hydro Dehazers • Petrochemical Column Internals

GET THE EAGAN EAGLE...
The Condensate Pump with the Big Advantages



The EAGAN EAGLE does not require a pit even though return lines may be only a foot above the floor. It handles steam heating loads up to 8000 sq. ft. at 20 psi.

The low cost EAGAN EAGLE handles far more capacity than any similar pump at the same price (to 8000 sq. ft. EDR at 20 psi.) In addition this high quality, quiet operating condensate pump:

- Meets the demand for a condensate pump with a low return inlet to eliminate the need for a costly pit
- Contains an all bronze EAGAN centrifugal pump with non-clogging, open impeller, stainless steel shaft, life sealed ball bearing
- Has a *standard* 1/4 hp capacitor type motor, not a costly, special, close-coupled, hard-to-replace motor
- Has a flexible coupling and flexible connectors on both suction and discharge pipes to isolate the pump and prevent pipe cramp, misalignment, wear and noise
- Has a large capacity safety factor providing for at least 1 to 3 "on off" operation

Other models are available with capacities to 100,000 square feet at 200 psi, all with the outstanding features that make EAGAN condensate pumps so popular.

Write, wire or call us with your pumping problems and let us bid on your job.

WALTER H. EAGAN CO., INC.
Pump Specialists Since 1920
2336 Fairmount Ave., Philadelphia 30, Pa.
STevenson 7-2300

Send me information on the EAGAN pumps checked:
☐ Condensate ☐ Boiler Feed ☐ Centrifugal
☐ Turbine ☐ Fuel Oil Pump & Heater Sets

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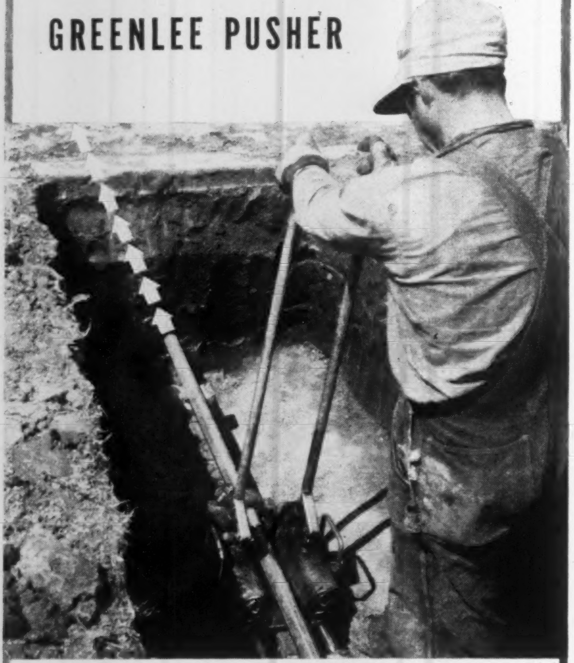
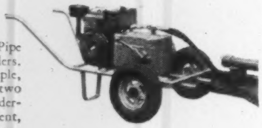
CUT COSTS ON UNDERGROUND PIPING INSTALLATIONS WITH GREENLEE PUSHER



Save hours of time, cut job costs with this quick, easy way of installing underground pipe. With a GREENLEE Hydraulic Pipe Pusher, *one man* pushes pipe *under* streets, walks, tracks, lawns, floors, and other obstacles. No costly tearing up of paving . . . eliminates extensive ditching, as just a short trench accommodates the Pusher. No tedious tunneling, backfilling, tamping, repaving. Compact, portable, powerful. Often pays for itself on first few jobs. Thousands in use for big savings of time and labor. Two models: one for ¾ to 4″ pipe, one for larger pipe, concrete sewer pipe, drainage ducts. Write for facts today.

POWER PUMP

For all models of GREENLEE Pipe Pushers and Hydraulic Pipe Benders. Makes the toughest pushing jobs simple, fast. Average pushing performance: two feet per minute. Rubber-wheeled undercarriage, available as extra equipment, provides convenient, easy way to transport and move about on job location.



TOOLS FOR CRAFTSMEN

GREENLEE

Greenlee timesaving tools for plumbing and heating work: Hydraulic Pipe Pushers • Hydraulic Pipe Benders • Tubing Benders • Pipe Bits Auger Bits • Spiral Screw Drivers • Chisels • And many more

Greenlee Tool Co., 2349 Twelfth Street, Rockford, Illinois

MEETINGS & CONVENTIONS

Continued

1957

NOV. 16-18—*Refrigeration and Air Conditioning Contractors National Association*, annual convention. Drake Hotel, Chicago. The association is at 10660 Carnegie Ave., Cleveland 6.

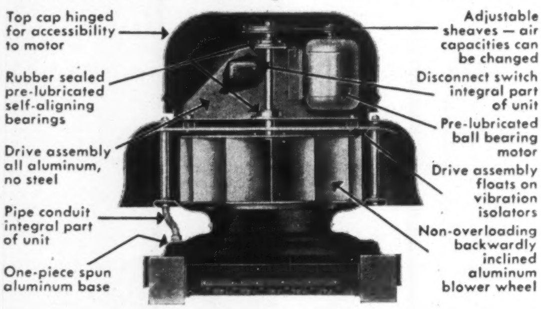
NOV. 16-18—*Air-Conditioning and Refrigeration Wholesalers*, annual meeting. Sheraton Hotel, Chicago. Information: 2607 N. High St., Columbus, Ohio.

NOV. 18-21—10*th Exposition of the Air-Conditioning and Refrigeration Industry*. International Amphitheater, Chicago. Air-Conditioning and Refrigeration Institute, 1346 Connecticut Ave., N. W., Washington 6, D. C.

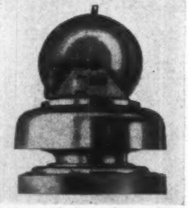
NOV. 19-22—*National Warm Air Heating and Air Conditioning Association*, committee meetings and annual convention. Morrison Hotel, Chicago. NWAHACA headquarters: 640 Engineers Bldg., Cleveland 11.

DEC. 4-5—*Third Annual National Construction Industry Conference*. Congress Hotel, Chicago. Information: J. J. Kowal, conference secretary, Armour Research Foundation, 10 W. 35th St., Chicago 16.

Lighter . . . because even the drive assembly is aluminum


Top cap hinged for accessibility to motor
Rubber sealed pre-lubricated self-aligning bearings
Drive assembly all aluminum, no steel
Pipe conduit integral part of unit
One-piece spun aluminum base
Adjustable sheaves — air capacities can be changed
Disconnect switch integral part of unit
Pre-lubricated ball bearing motor
Drive assembly floats on vibration isolators
Non-overloading backwardly inclined aluminum blower wheel

COOK Model BD All-aluminum Belt Drive Ventilators



Hinged hood makes motor easily accessible. Easy to clean.

Weighs only 250 lbs. in 16,500 cfm size

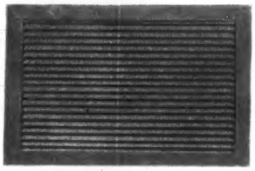
- 1,000 to 16,500 cfm.
- Only 39″ high in largest size.
- Requires built-up curb of only 6″.
- Low tip speeds.
- Light starting torque with aluminum blower wheel.
- Similar design in direct drive models.

Write for Catalog or see Sweet's Architectural File. In Canada write to H. F. Clark, Ltd., 421 W. Broadway, Vancouver, B. C.

COOK

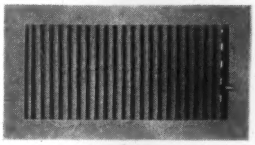
LOREN COOK COMPANY, Berea, Ohio

A-J NO. 42 SERIES RETURN AIR REGISTERS AND GRILLES



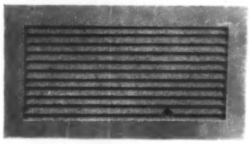
No. 42-H Grille

Face bars on 1/2" centers, 45 degree deflection. Minimizes see-through. Rims 7/8" beyond duct size. Screw holes countersunk. Standard finish — gray prime. Available with horizontal (42-H) or vertical (42-V) face bars. Depth — 13/16".



No. 432-V Register

Face construction same as No. 42 Grille. Multiple valve register body. Lever operator is removable. Gasket furnished. Depth in full open position — 2-3/16".



No. 442-H Register

Face construction same as No. 42 Grille. Opposed blade damper adjustable through face with a No. 2 or No. 3 Phillips Screw Driver. Gasket Furnished. Depth in full open position — 3-9/16".
Grille and register faces available in all aluminum on order.

Write for free catalog.

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3601 E. 18th St. Dept. H9 Kansas City 27, Mo.

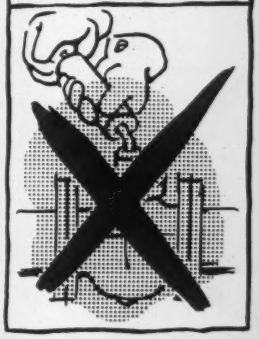
When you want results.. specify

DeZURIK
SHUT
OPEN

DeZurik Plug Valves

THEY DON'T LEAK
The resilient-faced plugs of DeZurik Valves guarantee dead-tight shut-off on any line despite dirt, grit or scale in the line. The cushioned closure seals around particles in the flow. Performance is the same, whether valving thick slurries, clear liquids or gases.

THEY OPEN EASILY
Eccentric Action, found only on DeZurik Valves, provides the easiest operation ever! The plug touches the seat only when the valve is closed. Opening the valve backs the plug away from the seat—no friction to overcome, no drag, no binding! One easy quarter-turn from wide open to dead shut!



THEY NEED NO LUBRICATION
DeZurik Valves need no lubrication! Their tight shut-off and easy operation result from the resilient-faced plug and eccentric design. No lubrication means no greases or guns to stock, no constant lube maintenance, and—most important —no product contamination on critical applications!

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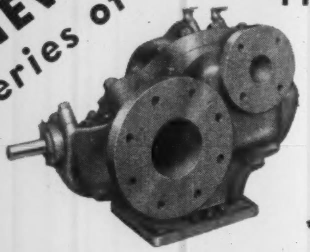
DeZURIK CORPORATION
SARTELL, MINNESOTA

here's an ANGLE 45°
that generously PAYS OFF

A NEW series of

AURORA®
TYPE A



two stage diagonally split case centrifugal

MULTI-PURPOSE PUMPS

You will find that the diagonally split case offers substantial new advantages while retaining all of the best features of the horizontally split case pumps — in that the entire rotating element can be removed without disturbing piping — or — disturbing the pump-motor-base alignment. CONSIDER —

these
PLUS BENEFITS

Suited to many applications, importantly BOILER FEED SERVICE as well as hot or volatile liquids duties.

•

Low NPSH Characteristics

•

Being self-venting they WILL NOT VAPOR LOCK

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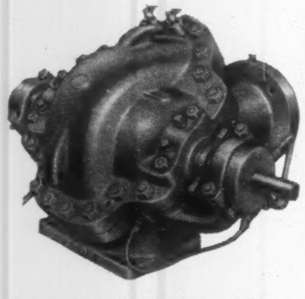
45° split allows both suction and discharge to be in the bottom half of casing but above the center line of the pump.



Aurora Type AJ Centrifugal Pump with Water Cooled Bearings and Stuffing Boxes

STANDARD

These 45° diagonally split case pumps have, as standard, 125# A.S.A. Suction Flange and 250# A.S.A. Discharge Flange. Type AJ Pumps are usually Bronze-Fitted but can be furnished All-Iron or Stainless Steel trim for high temperature conditions.

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THE NEW YORK AIR BRAKE COMPANY

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EXPORT DEPARTMENT — Aurora, Illinois — Cable Address "NYABINT"

MEETINGS & CONVENTIONS

Continued

1958

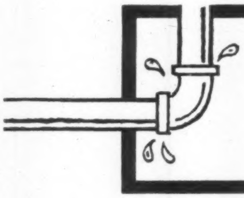
JAN. 27-29—*American Society of Heating and Air-Conditioning Engineers, Inc.*, 64th annual meeting. Pittsburgh. Information: A. V. Hutchinson, executive secretary, ASHAE, 62 Worth St., New York 13.

JAN. 27-30—1958 *Plant Maintenance and Engineering Show.* International Amphitheater, Chicago. Management: Clapp & Poliak, Inc., 341 Madison Ave., New York 17.

FEB. 17-20—*Seventh Annual Industrial Ventilation Conference.* Kellogg Center, Michigan State University, East Lansing, Mich. Information: Industrial Ventilation Conference, Continuing Education Service, Michigan State University, East Lansing, Mich.

MARCH 17-21—*National Association of Corrosion Engineers*, annual conference and exposition. Civic Auditorium, San Francisco. NACE headquarters: 1061 M & M Bldg., Houston 2.

MAY 4-7—*Air-Conditioning and Refrigeration Institute*, annual meeting. The Homestead, Hot Springs,



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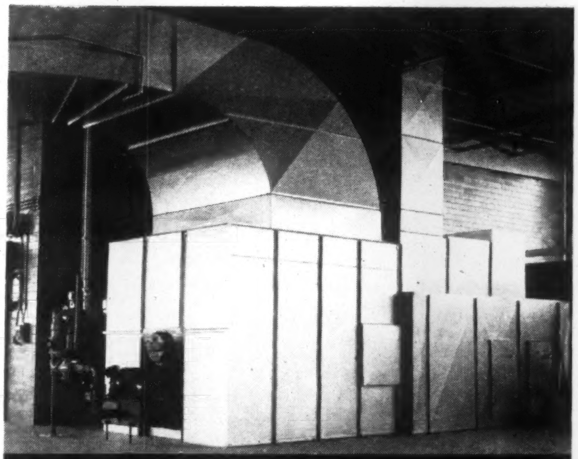

Jackson & Church furnaces

solve difficult heating problems of new Crown Cork and Seal plant —

INSTALLATION DATA

PLACE:

New lithograph plant of Crown Cork & Seal Company's Can Division, Philadelphia, operating five of the latest litho presses and five coaters and ovens

REQUIREMENTS:

Dependable heating designed to supply large volume of fresh outside air replacing oxygen consumed by lithograph equipment. Summer air conditioning to utilize same ducts and fans

HEATING UNITS SPECIFIED:

Three JACKSON & CHURCH GA-4750 units, having a total air delivery of 120,000 C.F.M. and 14,250,000 Btu input

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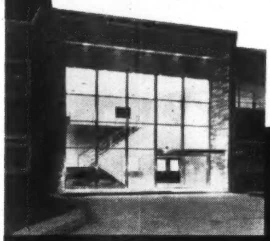
JACKSON & CHURCH - Div. of YORK-SHIPLEY, INC. York, Pa. (J-C furnaces - America's largest & most complete warm air heating line)

DISTRIBUTOR:

Furnace Distributors, Inc.
Philadelphia, Pa.

INSTALLER: Consolidated Air Conditioning



Modern facade' of Crown Cork & Seal Company's new plant in Philadelphia.

J-C

JACKSON & CHURCH
Division of
YORK-SHIPLEY, INC.
P.O. BOX 349, YORK, PENNSYLVANIA

NEW permanent dry-type

A-lum-O-Aire

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designed for industrial air-cleaning requirements

RESISTS RUST and CORROSION

Impervious to hazardous industrial atmospheres, new A-LUM-O-AIRE COPPER Filters are the practical solution for handling corrosion and moisture-laden fumes, vapors and gases. Copper wool, used as the filter media, is manufactured by Carey to precision standards from special alloys developed expressly for air cleaning. Mat retainers are copper plated for longer life with added protection against rusting and corrosion.

QUICKLY CLEANED for CONTINUOUS USE

Simply flush A-LUM-O-AIRE COPPER Filters with water or solvent and replace. No hazardous oils to add; no messy adhesives required. END pyramiding filter replacement costs NOW with the filter designed for the rugged demands of industry. Available in standard and high-velocity types for normal resistance or engineered to your specific size and capacity requirements.

America's *first* practical recleanable all-metal, dry-type air filter! Approved by Underwriters (Class 1)!

A-lum-O-Aire

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1880 Clifton Avenue, Dept. H-9
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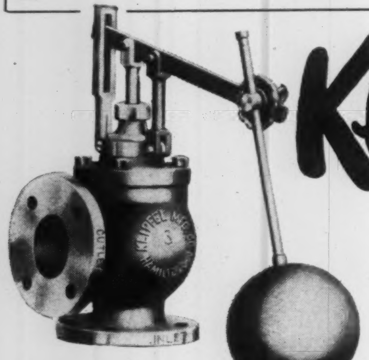
Tell me more—
about your new A-LUM-O-AIRE Filters and show me how we can save money on our air-cleaning activities.

Name____________ Title________
Company____________
Address____________
City____________ Zone____ State________

to keep liquids ON-THE-LEVEL



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- Also available with Klipfel's exclusive cup disc inner valve for tight control of liquids injurious to rubber and leather, and for higher pressures.

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MEETINGS & CONVENTIONS

Continued

1958

Va. ARI headquarters: 1346 Connecticut Ave., N. W., Washington 6, D. C.

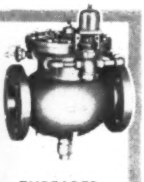
MAY 7-11—Western Air Conditioning, Heating, Ventilating and Refrigeration Exhibit and Conference. Shrine Exposition Hall, Los Angeles. Sponsored by Western Air Conditioning Industries Association. Information: Fred J. Tabery, exhibit manager, 3443 S. Hill St., Los Angeles 7.

MAY 19-23—National Fire Protection Association, annual meeting. Palmer House, Chicago. The association is at 60 Batterymarch St., Boston.

JUNE 9-13—Fourth International Automation Exposition and International Automation Congress. Coliseum, New York. Information: Richard Rimbach Assoc., 845 Ridge Ave., Pittsburgh 12.

JUNE 23-25—American Society of Heating and Air-Conditioning Engineers, Inc. and *American Society of Refrigerating Engineers,* joint meeting. Hotel Leamington, Minneapolis. ASHAE headquarters: 62 Worth St., New York 13. ASRE headquarters: 234 Fifth Ave., New York 1. ‡

WATER REGULATORS
1 to 300 Tons



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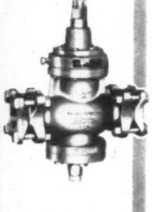
THREADED WELDING OR SWEAT FLANGES



BACK PRESSURE REGULATORS
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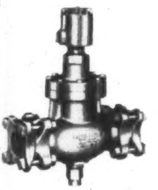
A Line of Heavy-Duty Refrigeration Control Valves designed primarily for Medium and Large Air-Conditioning and Industrial Refrigeration

VARIATIONS FOR SPECIAL APPLICATIONS



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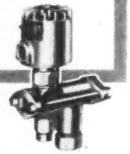

SOLENOID VALVES
1 to 1000 Tons

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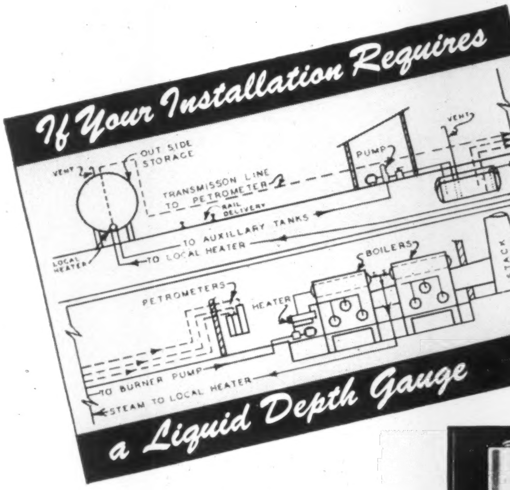
REFRIGERATING SPECIALTIES COMPANY
3004 W. LEXINGTON ST. CHICAGO 12, ILLINOIS
R/S CONTROLS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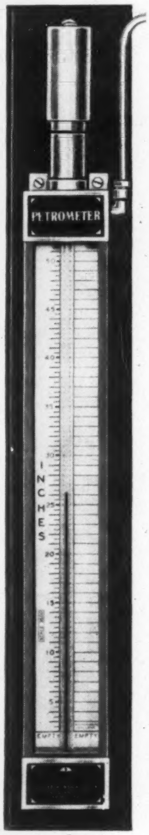
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Here's Why:

No troublesome moving parts—operates on the sound principle of the U-tube. Simple, dependable and accurate.

Large, easy-to-read vertical scale gives tank contents at a glance. Eliminates the cumbersome measuring stick and the inconvenience of climbing the tank.

Installation is easy—gauges can be installed on tanks above or below ground level and up to ¼ of a mile away. The tank assembly for the gauge can be installed even when the tank contains liquid. It can also be fitted in the tank separately to complete the tank work. The gauge can be connected any time later. Just tighten one simple connection and the job is finished.

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All set to save on fuel bills

any day, any night, all week!

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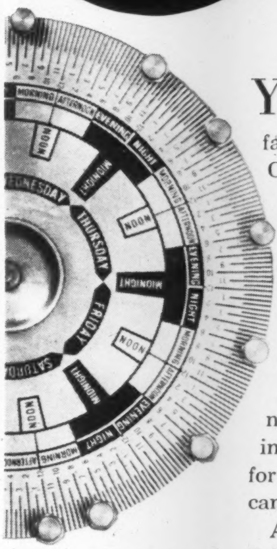
700 SERIES
7-DAY CALENDAR DIAL
TIME SWITCH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FRIDAY
SATURDAY

Dial is graduated into hours and half-hours. Fourteen dial trippers supplied. Available in 24, 120 and 240 volts; 25, 50 and 60 cycles. Lists as low as $29.50. Order from your jobber.

Turns heating equipment off when not needed

YOU can't beat the 700 series for promoting customer satisfaction through lower fuel bills! Once installed, it automatically turns heating systems ON as needed — turns them OFF during non-working-hours.

An entire week's program can be set in advance. ON-OFF can be programmed to any irregular daily schedule. Any day or days can be eliminated entirely. Monday morning ON can be earlier than usual for week-end pick up. Operations can be as close as 3 hours.

Air conditioning, ventilating, lighting, flushing, pumping and other operations can also be controlled on a weekly schedule with this 7-day time switch.

Write for information on the Paragon 2900 series to solve your off-schedule heating problems.

TODAY — Write for "Time is Money" — new Paragon handbook for you and your crews. Twenty pages of money-making ideas and handy application chart. Address Dept. 1811

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TWO RIVERS, WISCONSIN

That's right LOOK AGAIN

here's why the THERMOSTAT in Sterlco® TRAPS does more for you...

ALL TRAPS are NOT ALIKE

1. If the thermostat is damaged, the *spring action closes the trap*. Trouble is immediately located because radiation becomes cold — no waste of steam — no searching. Thermostats and seats easily replaced.

2. It compensates for pressure changes — operates satisfactorily even if pressures vary.

3. It cannot be damaged by excessive steam pressures or by freezing.

STERLCO THERMOSTATIC RADIATOR TRAPS

Keep radiators clear of condensate without wasting steam. Sturdy bronze bodies and covers—replaceable seats. Angle, Straightway, Corner or Vertical styles.

STERLCO FLOAT and THERMOSTATIC TRAPS

Ideal for installation and rehabilitation of unit heaters. Dependable, compact, large capacity, easy servicing and rugged construction makes Sterlco F & T's outstanding performers on unit heaters and other steam heating equipment.

Install the 3/4" 69B in the most convenient way

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ELEMENTARY THERMODYNAMICS—Third Ed. By Virgil Moring Faires. 379 pp. MacMillan Co., 60 Fifth Ave., New York 11. $6.75.

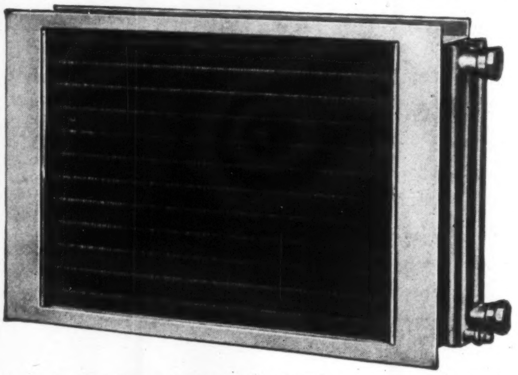
STANDARD FOR THE INSTALLATION OF AIR CONDITIONING AND VENTILATING SYSTEMS OF OTHER THAN RESIDENCE TYPE — NFPA publication No. 90A. 24 pp. National Fire Protection Association, 60 Batterymarch St., Boston. 50c.

PROCEEDINGS OF THE 1957 SOLAR FURNACE SYMPOSIUM—116 pp. Association for Applied Solar Energy, 3424 N. Central Ave., Phoenix, Ariz. $5.00.

DISTRIBUTION OF AIR WITHIN A ROOM FOR YEAR-ROUND AIR CONDITIONING-PART II—By Harold E. Straub and Michael Ming Chen. University of Illinois Engineering Experiment Station bulletin No. 442. 44 pp. University of Illinois, Urbana, Ill. $1.00.

New . . . REMPE "Hi-Cap" STEAM HEATING COILS WITH DEFROSTER

For Use in Combination With Air Conditioning Coils Or As Tempering and Booster Units in Long Heating Ducts.



Available in Single Row Type with BTU per hour capacity from 60,000 to 360,000. In Double Row Type, for heavy duty service, in capacities from 129,000 to 775,000 BTU per hour. Heavy gauge steel casings. Copper tubes and headers. Tested 350 lbs. air pressure for steam working pressures up to 125 lbs. Defroster-standard equipment. Also suitable for hot water.

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REMPE CO.

REMPE COMPANY

342 N. Sacramento Blvd., Chicago 12, Ill.

Complete facilities for fabrication of pipe coils—all types—all materials. Engineering service. Send details for price.

Quickly erected, factory-built refractory Van-Packer Stack gives economy, permanence, efficiency

The Van-Packer Stack is quickly and simply erected. Its cylindrical 3-foot long sections are cemented one on top of another with acidproof, high-temperature cement and secured with aluminum drawbands. Sections are centrifugally-cast of refractory material, encased with an aluminum jacket.

On the average, initial costs of the Van-Packer Stack are 2/3rds less than brick, ½ less than tile-lined concrete block, about the same as steel. Upkeep costs on the Van-Packer Stack are eliminated by its aluminum jacket.

Non-corroding refractory sections provide masonry permanence, last 3 times longer than steel (average). Because the insulated sections prevent excessive heat loss thru stack walls, the Van-Packer provides more draft than a comparable steel stack, about the same draft as a comparable brick stack.

Van-Packer offers two types of sections — STANDARD for furnaces and boilers, HI-TEMP for incinerators. Stack sections come in 7 diameters from 10" I.D. to 30" I.D. to meet your requirements.

Available nationwide thru Van-Packer heating and building material jobbers and manufacturers representatives. See "Chimneys—Prefabricated" in Yellow pages, or write Van-Packer.

Send for 80-page data file with guying, installation method, test reports

Van-Packer PREFABRICATED REFRACTORY Stack

Van-Packer Company • Division of The Flintkote Company
P. O. Box No. 306 • Bettendorf, Iowa • Phone: 5-2621

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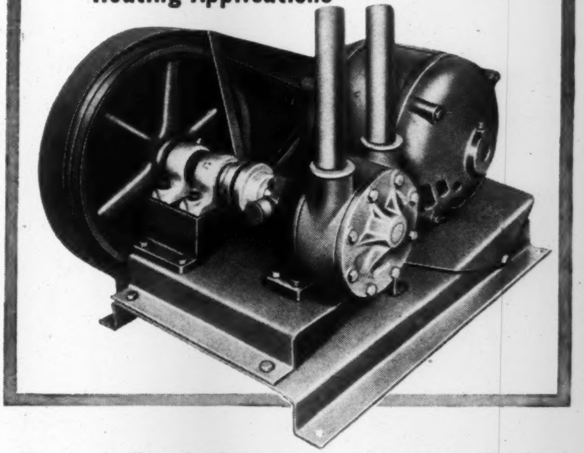
new TUTHILL SU PUMP UNIT

- **For Handling Heavy Fuel Oils**
- **In Packaged Boiler and Commercial Heating Applications**

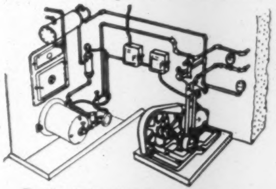


Economically priced, TUTHILL'S SU PUMP UNIT has been specifically developed for handling heavy fuel oils in commercial heating applications and with packaged boilers.

This "v" Belt Driven Unit is compact—complete units measure only 24¼" x 14⅝". Quiet operation is insured by the 2 or 4 "v" Belt Drive and the integral gear positive displacement pump design.

Construction features which provide dependable trouble-free operation, lower maintenance costs, include two ball bearing pillow blocks, one point take-up for simple adjustment of belt tension, removable belt guard and new fabricated steel base with versatile motor mounting.

SU PUMP UNITS can be furnished with a wide variety of pumps and motors for pressures up to 300 psi, capacities to 2030 gallons per hour. Sub-assemblies of pump, stub shaft, pillow block and sub-base are also furnished separately as a unit for incorporation into systems by boiler and furnace manufacturers. Write today for complete information.



Typical Application of SU Unit

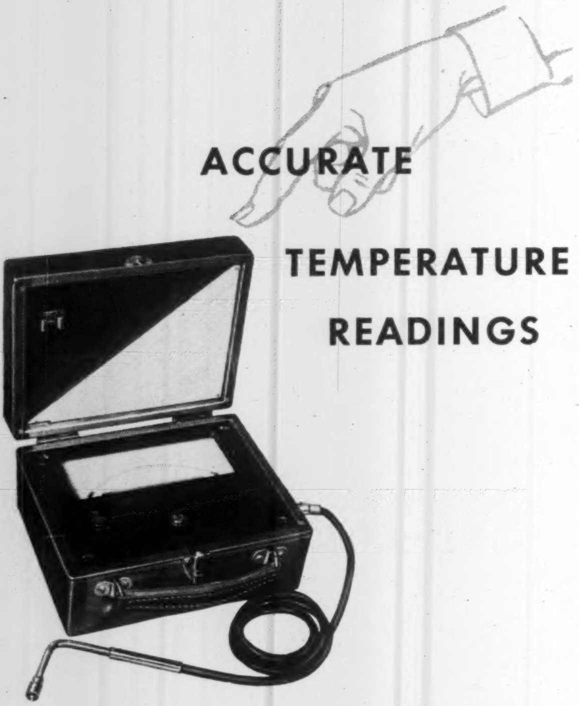
TUTHILL PUMP COMPANY
947 East 95th Street, Chicago 19, Illinois
Gentlemen:
Please forward Catalog describing Tuthill SU Pump Units.

NAME________ COMPANY________
TITLE________
STREET________
CITY________ STATE________

TUTHILL PUMP COMPANY

947 East 95th Street, Chicago 19, Ill.
Canadian Affiliate: Ingersoll Machine & Tool Company, Ltd., Ingersoll, Ontario, Canada

PUMPS FOR YOUR PURPOSE



ACCURATE

TEMPERATURE

READINGS

- Hot Water Systems
- Floors, Walls, Ceilings
- Refrigerated Coils
- Insulation
- All Other Low Temps.

You can accurately read any low surface temperature with the Alnor Type 2300 Surface Pyrometer—in 3 to 5 seconds.

Take this rugged, portable instrument to any job in the field and see how performance to laboratory standards can save invaluable time in balancing out a system... save the money lost on call-backs. Large 6″ mirrored scale is direct reading, no conversion... no errors in readings ... 1° per division. Precision jeweled movement is protected against abuses of portable service by sturdy walnut case. Comes complete with matched thermocouple and lead ready to use on your next trip out. Send for Bulletin 4257 and get the complete story on the full line of Alnor Pyrometers. Just tear out this ad and mail on your letterhead to: Illinois Testing Laboratories, Inc., Room 513, 420 N. LaSalle St., Chicago 10, Ill.

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FOR EVERY INDUSTRY

NEW BOOKS & REPORTS

Continued

ASTM Standards on Thermal Insulating Materials—214 pp. American Society for Testing Materials, 1916 Race St., Philadelphia 3. $3.00.

Air Pollution in Connecticut—Report of cooperative survey by U.S. Public Health Service and Connecticut State Department of Health. By Roy O. McCaldin and Paul A. Kenline. 111 pp. Community Air Pollution Program, Robert A. Taft Sanitary Engineering Center, 4676 Columbia Pkwy., Cincinnati 26. Free.

Graphical Design Procedure for Bolted Flange Connections (Lap Joints) Meeting ASME Code Requirements—Manual sheet M-l. 36 pp. Manufacturing Chemists' Association, Inc., 1625 Eye St., N.W., Washington 6, D.C. $1.25.

Underground Corrosion—By Melvin Romanoff. National Bureau of Standards Cir. 579. 227 pp. Superintendent of Documents, U. S. Government Printing Office, Washington 25, D. C. $3.00.

Gasification of Pulverized Coal in Suspension—By C.G. von Fredersdorff, E.J. Pyrioch and E.S. Pettyjohn. IGT research bulletin No. 7. 72 pp. Institute of Gas Technology, Technology Center, Chicago 16. $5.00.

Standard for the Construction and Installation of Water Tanks for Private Fire Protection Service—NFPA publication No. 22. 108 pp. National Fire Protection Association, 60 Batterymarch St., Boston. $1.00.

Catalogs of Technical Reports—Eight catalogs list all reports in the field of welding in collection of Office of Technical Services, U.S. Department of Commerce. They are: CTR-324 Welding-Part I, Steel and Ferrous Alloys, 1932-57; CTR-325 Welding-Part II, Aluminum and Magnesium, 1934-57; CTR-326 Welding-Part III, Miscellaneous Metals, 1925-57; CTR-327 Welding-Part IV, Arc Welding, 1936-57; CTR-328 Welding-Part V, Resistance Welding, 1934-57; CTR-329 Welding-Part VI, Gas Welding, 1925-57; CTR-330 Welding-Part VII, Electrodes and Equipment, 1926-57; CTR-331 Welding-Part VIII, General Welding Methods, 1932-57. Office of Technical Services, U.S. Department of Commerce, Washington 25, D.C. 10c ea.

Evaluation of Air Pollution in the State of Washington—Joint report of U.S. Public Health Service and State of Washington Department of

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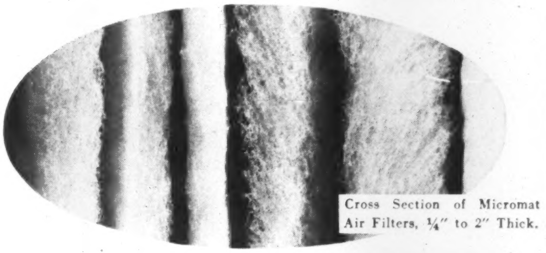

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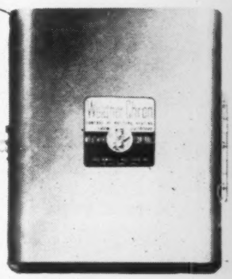

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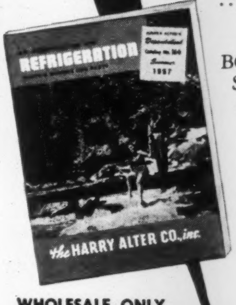

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Health. By E.R. Hendrickson and D.M. Keagy. 156 pp. Community Air Pollution Program. Robert A. Taft Sanitary Engineering Center, 4676 Columbia Pkwy., Cincinnati 26. Free.

BUILDING EXITS CODE—1957 Ed. NFPA publication No. 101. 256 pp. National Fire Protection Association, 60 Batterymarch St., Boston. $1.50.

FILLER METAL COMPARISON CHARTS—24 pp. American Welding Society, 33 W. 39th St., New York 18. $2.00.

STANDARD FOR CHIMNEYS, FLUES AND VENTS—NFPA publication No. 211. 15 pp. National Fire Protection Association, 60 Batterymarch St., Boston. 50c.

FOGLE'S ENGINEER'S HANDBOOK—1958 Ed. William Fogle, Publisher, Box 2322 Station 28, Los Angeles 28. $15.00.

CODE FOR PROTECTION AGAINST LIGHTNING—NFPA publication No. 78. 46 pp. National Fire Protection Association, 60 Batterymarch St., Boston. 50c. ‡

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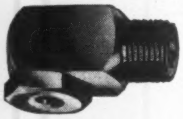

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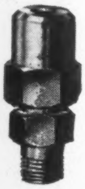

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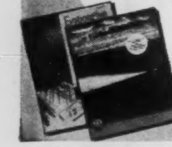

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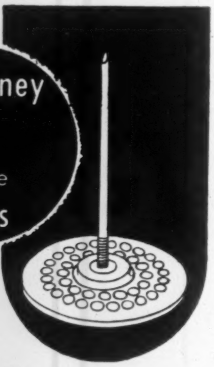

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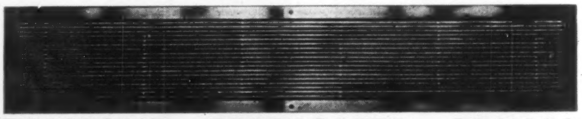

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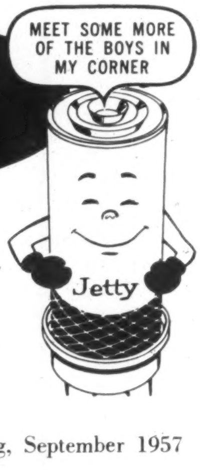
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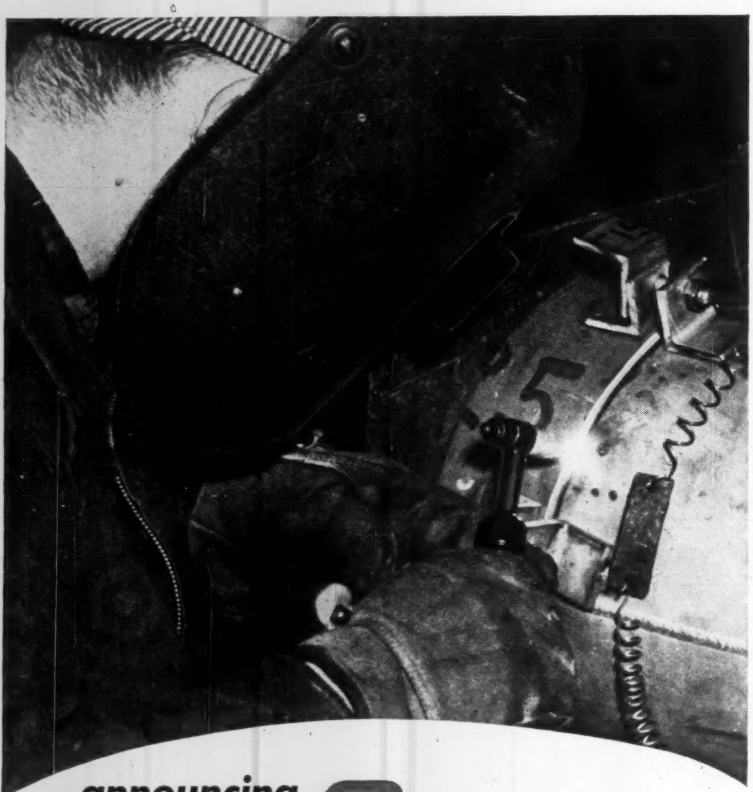

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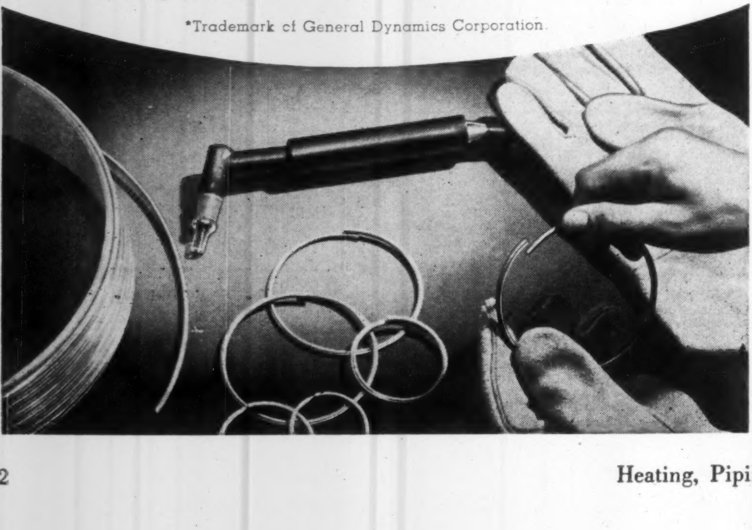

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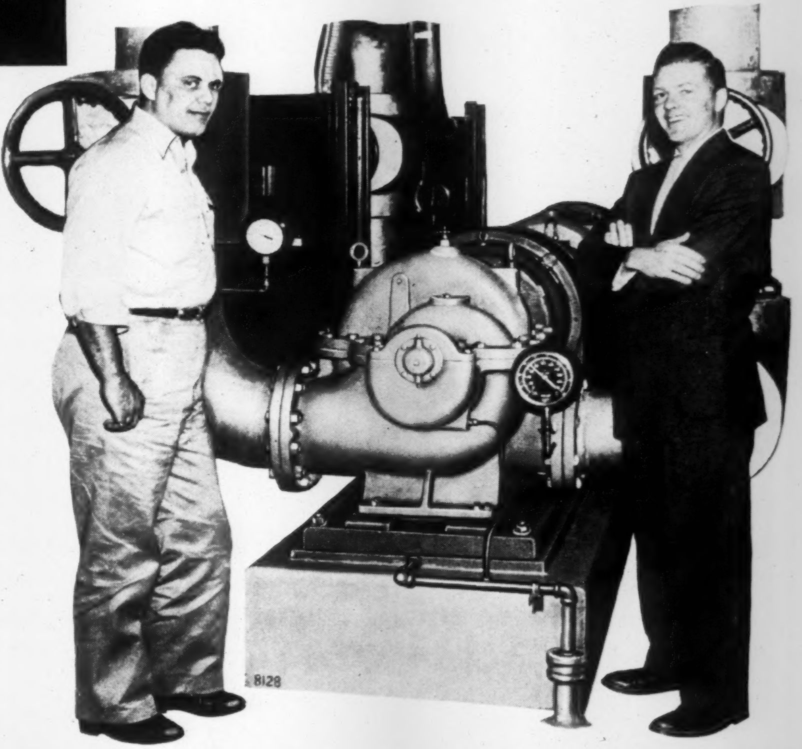
selected by contractor for "long service at low cost"



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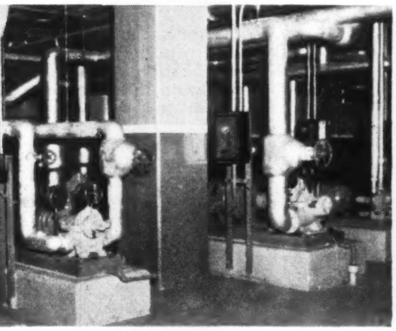
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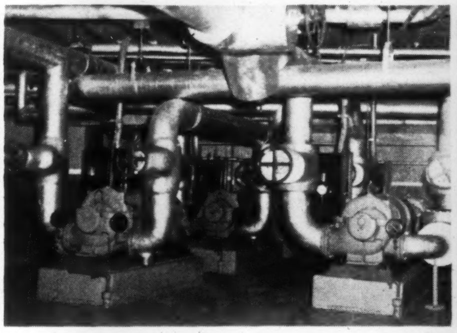
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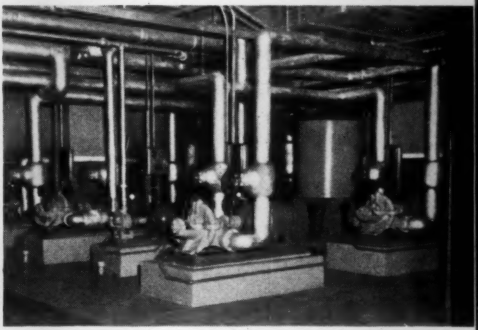
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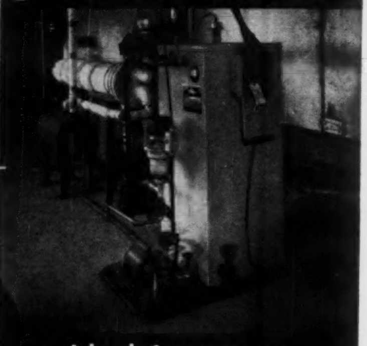

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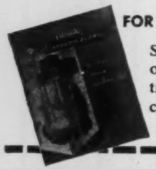

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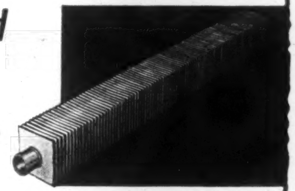

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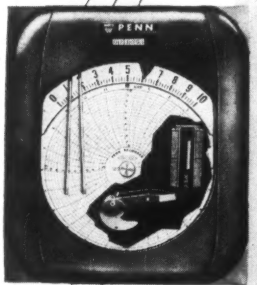

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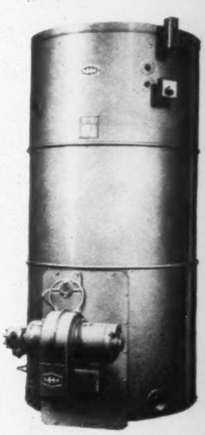

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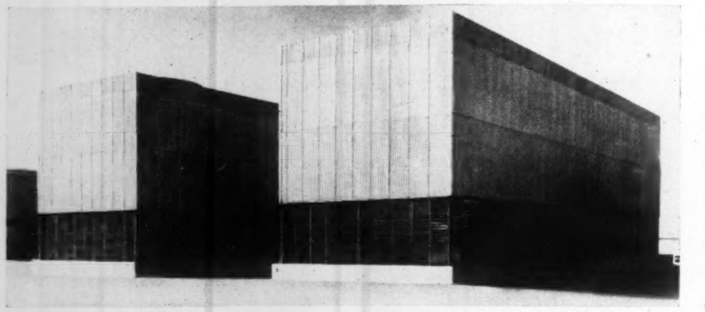

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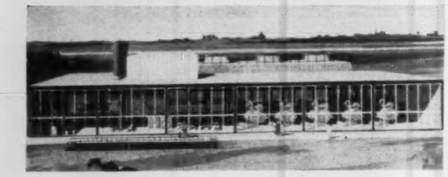

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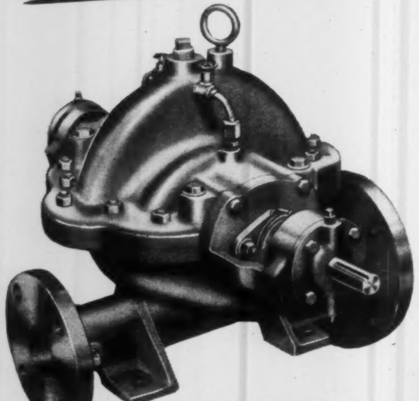

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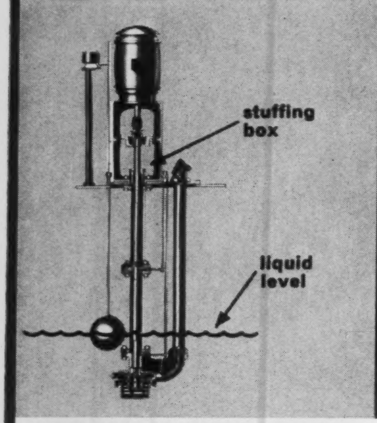
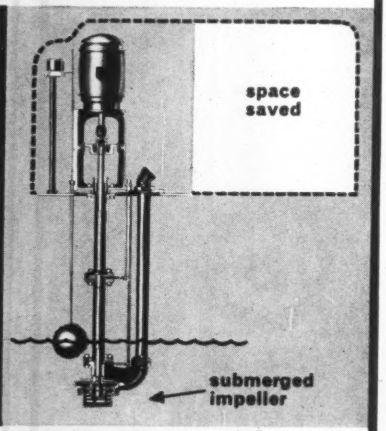


ELIMINATE LEAKAGE. Stuffing boxes and seals are not under liquid pressure. With the Yeomans Vertical Wet Pit Pump there are no costly, annoying, or dangerous liquid leaks, as with horizontal pumps.



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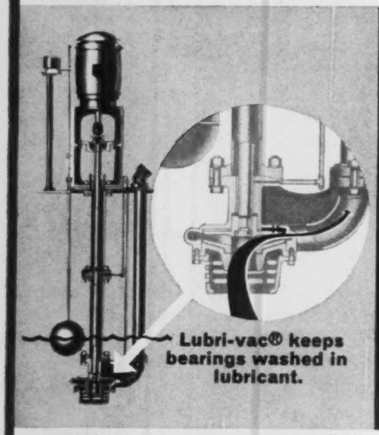

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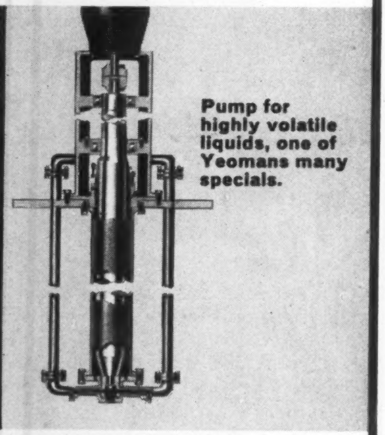
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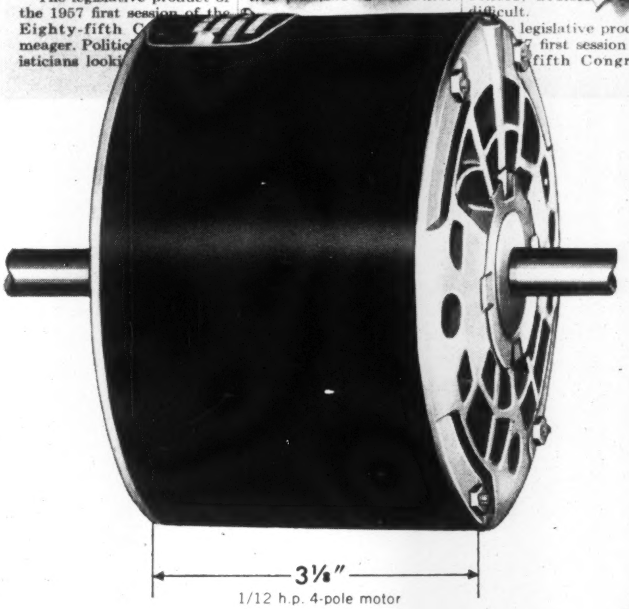
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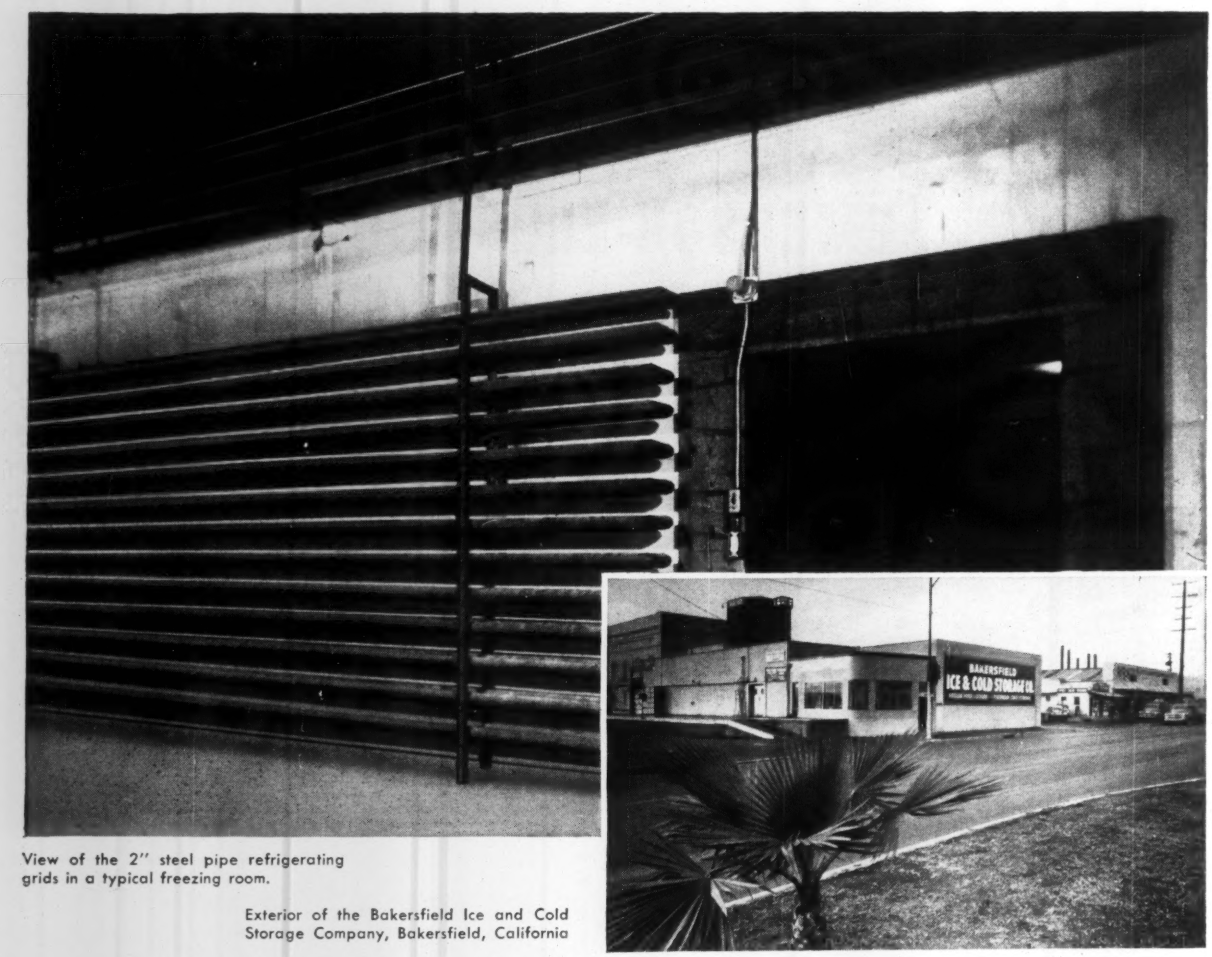

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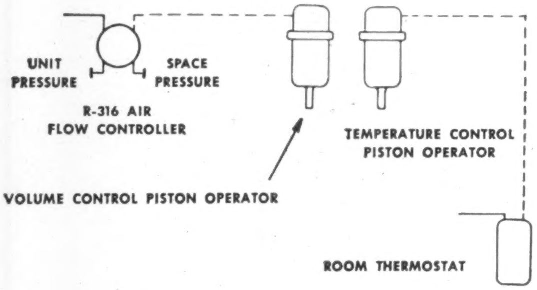
The R-316 operates at any pressure difference from approximately 0 to 1 inch wg and will produce a 1 psi air pressure change on pressure difference changes of less than .005 inch wg.

If your plans call for high velocity, double duct air conditioning, a Johnson Pneumatic Control System with provision for constant volume control will help you produce incomparable results. Ask your local Johnson branch for complete details or mail the coupon.


UNIT PRESSURE
SPACE PRESSURE
R-316 AIR FLOW CONTROLLER
TEMPERATURE CONTROL PISTON OPERATOR
VOLUME CONTROL PISTON OPERATOR
ROOM THERMOSTAT

Typical temperature-volume control arrangement for a high velocity mixing unit. R-316 Air Flow Controller insures delivery of a constant volume of air, compensates perfectly, *instantly,* for variations in inlet pressure of hot and cold air supply.

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PNEUMATIC SYSTEMS

DESIGN • MANUFACTURE • INSTALLATION • SINCE 1885

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Please furnish details on your new R-316 Air Flow Controller.

Name____________________

Company____________________

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